POWER PLANT ENGINEERING

THE POWER ENGINEERING AND MAINTENANCE MAGAZINE FOR EVERY INDUSTRY

NOV 8 - 1943
DETROIT
TECHNOLOGY DEPT.

Exhaust Steam Use in Armor Plant

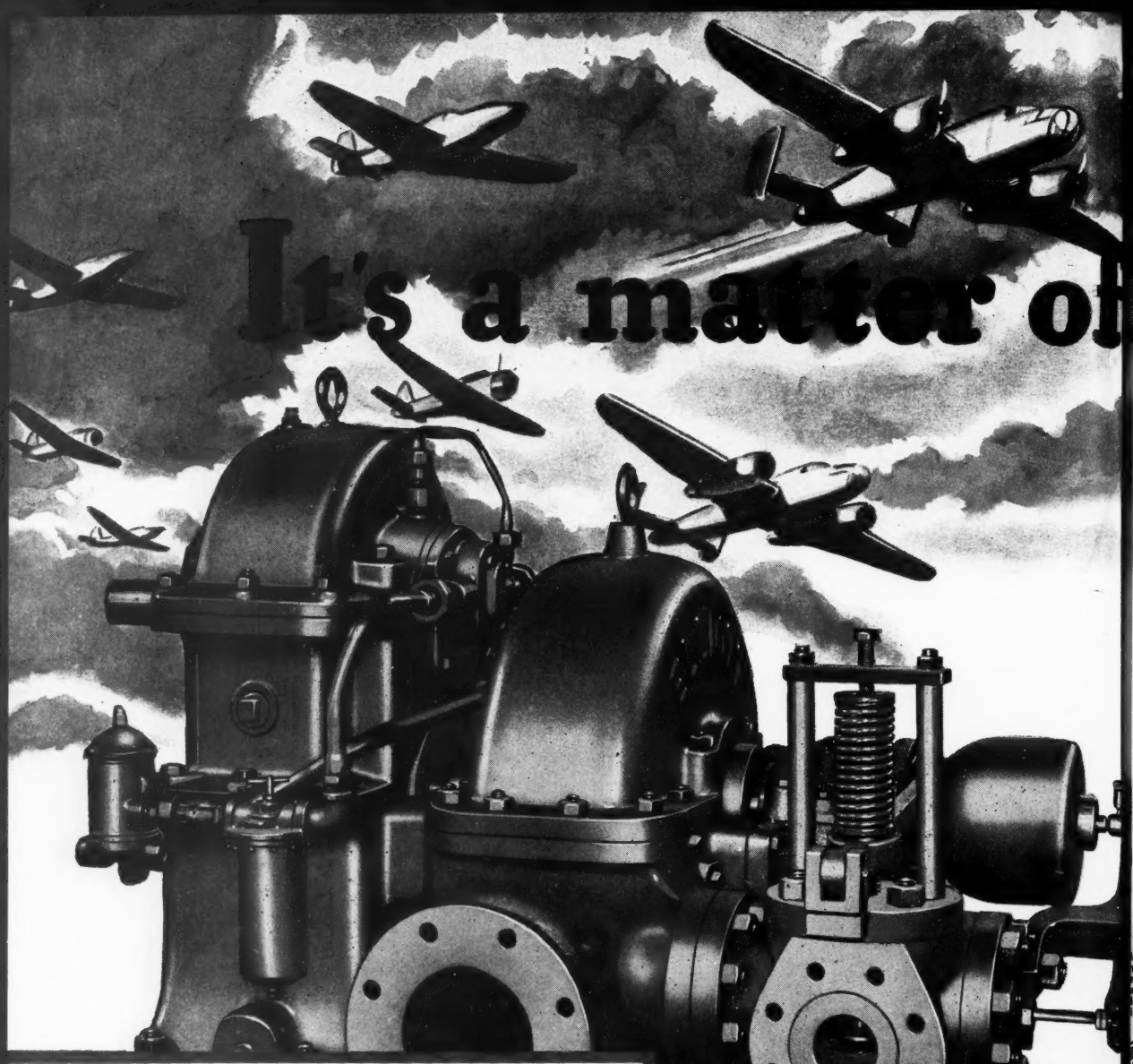
Superheater Problems in Wartime Conversions

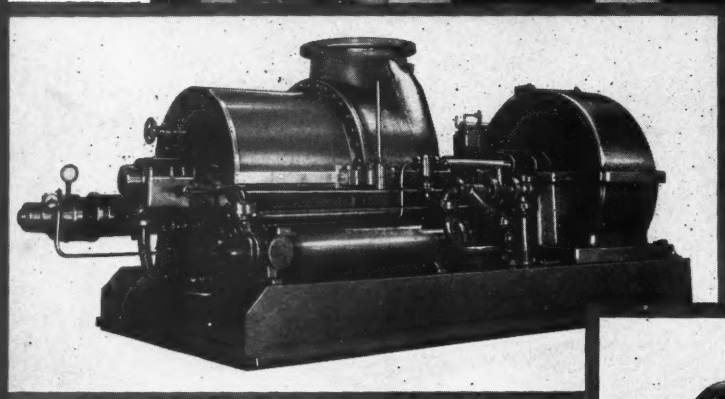
Uses for 3-Dimensional Drawings

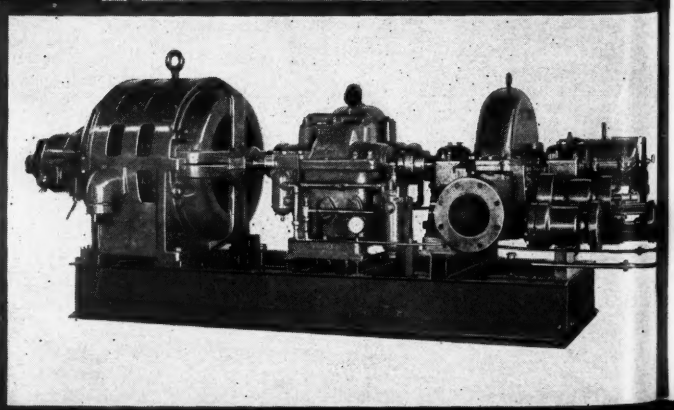
Overfire Air Performance

Controls for Triple-Rated Transformers

NOVEMBER
1943







The large photo above shows the Elliott mechanical drive turbine with built-in reduction gearing. This type of unit is in wide use. The two smaller photos show larger units, the gear assembly being coupled.

high-octane gasoline

The thundering skies over Nazidom grow ominously blacker, in spite of U-Boats, "flak", and enemy fighter planes. America's high-octane "gas" is largely powering the rain of destruction now blasting the industrial heart of enemy Europe.

The production of this Victory-making gasoline utilizes numbers of Elliott mechanical drive turbines, many with accompanying reduction gears. These units are used on refinery pumps everywhere, as well as in power plant drives for fans, pulverizers, and in units for the process industries making explosive components. Gears are used wherever the driven member operates at a speed other than the best operating speed of the turbine.

Elliott mechanical drive turbines are universally favored as sturdy, dependable drive units. Where geared reduction is needed, Elliott builds both gear and turbine, the two elements being separate in the larger sizes, but in smaller sizes the gears are built-in and actually part of the turbine assembly in a compact, space-saving unit. Gears are of approved tooth form adhered to with extreme accuracy, thus insuring maximum quietness in operation.

If you have an application for a direct-connected or geared turbine, Elliott has the unit to fit. Write us.

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gway plants of
ott Company.

ELLIOTT COMPANY

Steam Turbine Dept. **JEANNETTE, PA.**

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Elliott

GEARED TURBINES

H-678

DIESELS DRAG 'EM

MOSQUITO bombers in the rough, these hundred-ton spruce trees can be called real "war plants." Hauling these fallen giants out of the woods and to the mill is the job of Diesels.

In lubricating not only these high-speed Diesels, but also the large stationary units in power plants and pumping stations, Texaco is saving money for operators by assuring longer service between inspections and overhauls.

Increasing the life of rings, pistons, liners and bearings, both *Texaco Algol* and *Ursa Oils* keep rings free in their grooves, valves active, ports clear, assuring piston seal that means full power and maximum fuel economy.

Why not ask the cooperation of a Texaco Lubrication Engineer, available through more than 2300 Texaco wholesale distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, New York.

THEY PREFER TEXACO

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

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REG. T. M.

TEXACO Lubricants and Fuels

FOR ALL DIESEL ENGINES

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

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Contents, November, 1943

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Cover: Baptism by High Voltage—Powerful X-ray rectifier tubes enclosed in glass cylinders are shown here after withstanding 155,000 volts for 15 minutes. A grounding stick (insulated bar with a ground wire) is used to discharge excess voltage after test has been completed. (Photo courtesy Westinghouse)

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THE FORMER WAY
Milling eccentric key seats in finished crankshafts required 11 hours on a $75,000 machine.
THE HENDY WAY
requires but 4 hours, on a relatively simple-to-operate $2500 tool.
Time Savings
THAT SPEED VICTORY
When the seven hours saved on this one operation are multiplied by over 400 engines, the total amounts to more than a year of eight-hour days gained in speeding production for victory. But important as this saving may be, it is only a part of the story . . . it is only one of many Hendy short-cuts which have been made by adapting streamlined, mass-production methods to the building of giant steam engines, steam turbines and marine reduction gears.
This saving of time is one of the main reasons the Iron Men of Hendy have been able to produce so huge a volume in so short a time. When victory is won and Hendy methods are directed toward the production of industrial machinery, they will guarantee similar savings.
JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
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Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.
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By the use of special jigs and fixtures that automatically assure precision alignment, the time required to assemble Hendy crankshafts has been reduced from 112 hours to less than 4—an increase in production speed of 2800%.

FRONT LINES

A READER says that he likes many of the ideas about housing expounded in the Revere Copper & Brass booklets referred to in these columns. But he says the big obstacle to them is not the difficulty of building them or of developing the mass production factories in which to build their elements or the fact that many people in the building materials field are opposed to them or feel that they cannot be produced at low cost. It is the simple fact that most people want the good old-fashioned type of house—a salt-box or Cape Cod or just plain American small town design (often very good, too)—rather than the dream house of the future. If you doubt this, says our friend, look around the Middle West and see what proportion of the houses built there following Chicago's Century of Progress Exposition of 1933 were of modernistic design. One of the features of that Exposition was a very complete and interesting exhibit of modern homes. Millions of Middle Westerners inspected them. How many of those people built them? Our friend says that most people are hidebound reactionaries, when it comes to building their own homes, especially after having lived in city apartments. Tradition, the influence of the home in fiction and poetry, recollection of homes admired in their youth by men not yet 50—who can say what makes them want the salt-box house in preference to the dream home of plastic and chromium? But they do. Much as we think a great deal of the opposition is purely commercial, we must regretfully agree that most people probably won't want the dream home, even if they can get it. If only people weren't human beings——

IF WINSTON CHURCHILL, who gave a free plug to Basic English in his recent Harvard University speech, had used Basic in one of his most famous speeches to his people, he would have been unable to utter that dogged, defiant sentence in which he offered them nothing but "blood, sweat and tears." Instead, he would have been forced to offer in Basic nothing but "blood, head water and eye water." Somehow that doesn't sound Elizabethan; it sounds more like Beowulf. And good old Winnie is nothing if not Shakespearian. No, we don't think he would get very far with Basic English himself. Another Englishman says Basic is simply one more form of Pidgin English, useful for calling porters, since the English are notoriously lazy about languages. But the second commentator is in favor of it from a purely selfish point of view, having vainly attempted to learn Russian, Arabic, Persian and Chinese.

JUST as the pontifical commentator on the radio was pontificating that "Our demonstrated aerial superiority in the Pacific war theater warrants us in the belief that, all other things being equal—blah, blah, blah—" our eyes were caught by a newspaper headline "Air Superiority Not Ours, Says Pilot in Pacific" over a despatch by George Weller from Munda, reporting a conversation with the commander of a crack unit of fighter planes. Is it any wonder that there are skeptics in this world?

WE HAVE recently had some interesting correspondence with the inventor of a new method of generating power from the wind. This is a real big-scale idea, involving very large generating units each developing 100,000 or 200,000 hp. We fear, however, that this inventor is 500 or 1000 yr ahead of his time. Perhaps some day the human race will have depleted its fossil fuels close to the vanishing point, the synthetic chemists and the physicists will have been unsuccessful in producing enough of the required substances to furnish the necessary power through atomic disintegration and, pending that discovery, the race will have to investigate wind, sun and tide power. But now every time we think of these, we also recall the lamentations uttered almost 20 yr ago to the effect that our petroleum reserves wouldn't last until 1943. We recall that within a year or two after these Jeremiahs had spoken, a great wave of new oil discoveries swept the world. Today, with only a few years of known oil reserves in this country and with a mounting dependence on the internal combustion engine, we have a tremendous reserve of "engineer's oil"—oil that can be recovered from shale and coal—and an expansion of exploration may yield more natural oil. Coal reserves are good for a long time. So it's hard to see how we will need to depend on wind or sun or tide power for a long time to come. If by that time the human race hasn't figured out something new in physics or chemistry, it will have to go back to the original horse of the horsepower. But—suppose there aren't any horses left then, either! There IS something to worry about!

WHILE EMPHASIS in public metal scrap collections is currently focussed on iron and steel through the Victory "Scrap Bank" Drive, the WPB Scrap Processors Branch is working intensively in commercial channels to step up and improve the flow of non-ferrous scrap. The aim is to induce dealers to gear their trade practices to wartime requirements, and to locate "hidden" supplies in quarters not covered by inventory reports to the Bureau of Mines. The fact that the scrap bank program is concentrated on iron and steel does not mean that a public campaign devoted to non-ferrous metal might not be needed in the near future. The Scrap Processors Branch and the industry divisions are exerting every effort to turn up all possible quantities of copper, brass, bronze, aluminum, and other metals from commercial sources before considering any appeal to the general public.

AS OF September, 1943, approximately 62,000,000 bbl a year of residual fuel oil has been saved through conversion to substitute fuels. The savings by districts are:

District 1	48,537,185 bbl
District 2	10,146,737 bbl
District 3	1,301,790 bbl
District 4	110,496 bbl
District 5	1,967,290 bbl

REPORT ON POSTWAR Employment and the Settlement of Terminated War Contracts has just been issued in a 16-page booklet by the Committee for Economic Development. It is a statement on national policy by the Research Committee of C.E.D., and the fact that Ralph Flanders is chairman of this committee should be sufficient guarantee that this is no mere nebulous theorizing and wishful thinking. The report, after discussing the intimate relations between the two factors named and their fundamental importance, makes specific recommendations for needed Congressional action on the following four points: the Contract Settlement Board; Delegation of Authority to Contracting Agencies to Make Final Settlements; Expansion of the Legal Machinery of the Federal Government; Mandatory Loans to Contractors and Sub-Contractors. Every engineer and engineering executive in industry will be intimately involved in the problems discussed in this report and should get a copy either through his local C.E.D. regional committee or from C.E.D. headquarters at Room 3311, Department of Commerce Building, Washington, D. C.

THE RECENT remarkable development of glass tanks or vats for industrial use, says R. B. Tucker of Pittsburgh Plate Glass Co., is one of the most important advances in the glass industry. Dozens of industries are turning to glass for their tanks and installation of the tanks and relining of existing units with glass are increasing rapidly. This use of glass is not to be considered as merely temporary. Glass tanks are of high tensile and compressive strength, are impervious to chemicals and liquids of almost any type, are non-absorptive and non-porous and present a hard, sanitary surface requiring practically no maintenance. Tanks are manufactured complete at the factory, but if new linings are required for existing tanks, crews of installers are prepared to move into the plant for relining tanks previously lined with copper, rubber or other critical war materials.

QUANTITATIVE MEASUREMENT and accurate observation of the actual flow of fluids around an obstruction, such as the hull of a ship or a pipe or baffle, are now possible by means of a method recently developed at Massachusetts Institute of Technology, says the Industrial Bulletin of Arthur D. Little, Inc. This method is analogous to that wherein engineers use polarized light, produced with optical equipment, to render visible the strains in plastic models of solid structures, such as gears. In the analysis of fluid flow, a suspension of bentonite (a clay found abundantly in the West) in the fluid serves to modify polarized light shining through the transparent walls of the experimental channel, just as the plastic modifies light in the analysis of strains in solids. The bentonite particles are very small and light and move exactly where the fluid takes them. As has been repeatedly pointed out, a great deal of industrial equipment has been constructed in the past on the assumption that the fluid flows through certain passages in the equipment exactly as the trained arrows showed it on the blueprints and as the very complicated mathematical analysis showed it ought to flow. Now perhaps we shall be able to find out how it actually does flow.

SHORTAGES in the supply of Freon-12 refrigerants will continue for some months, members of WPB's General Refrigeration and Air Conditioning Industry Advisory Committee and of the Industrial Refrigeration Industry Advisory Committee were told at a recent joint meeting. The completion of a new plant in February, 1944, will provide some relief, Government officials stated, and there is some possibility that another plant will be built. The report of the Task Committee on requirements for refrigeration equipment was also presented at the meeting. The estimated amount of necessary replacement equipment for 1944 indicates that considerable equipment is being operated beyond its normal life expectancy at present, and that it will be impossible to make necessary replacements in food processing and storage facilities, and in industrial installations of refrigeration unless the amount of equipment available in 1943 is greatly augmented next year.

SENATE to Hear of Cartel Evils said a recent newspaper headline. But a recent American visitor to England reports that he was shown how the British attitude towards cartels and large monopolies is entirely different from ours. He was told that the British wouldn't allow their large companies to fail and that there might be some difficulties in Anglo-British co-operation if we do not modify our Sherman anti-trust laws. Certainly there is a wide gap here in the traditions and attitudes of the two countries on this subject.

DEPARTMENT OF LIBERAL EDUCATION in the House Organs in 15 min a Day. The Effect of Humidity on Electrical Measurements—General Radio Experimenter, Aug. 1943. Our Comeback at Pearl Harbor: the first story we have seen that gives any technical details of what happened and what has been done to repair the damage, illustrated with official U.S. Navy photographs of the damaged ships and the repair work done on them—Compressed Air Magazine, Oct., 1943. Blowdown: types, methods of calculating, diagrams of equipment—The Betz Indicator, Sept., 1943. We Hire the Handicapped: details of how the Jacques Kreisler Manufacturing Co. has successfully worked out the problem—American Mutual Magazine—Aug., 1943. Canada Puts River to Work: details of the La Tuque project on the St. Maurice River—The Power Specialist, July-August, 1943.

•

IF YOU WANT to know what's going to happen, read the comic strips. Wm. Schwindler, chief aeronautical engineer for Grumman, expounded this idea to a group of friends not long ago. "All the engineer does is try and keep up with the comic strip guys. Look at the death ray. It's been in the comic strips for 3 or 4 yr and you see how we're headed toward it now with radar. . . . Take the bazooka. Probably the guy that invented that saw it as a kid in a comic strip. Having seen it in his impressionable years, he later made it mathematically possible. Why, they had amphibious tanks and pilotless planes and even paratroopers. Somebody made a paratroop moving picture and when the picture was exhibited in Russia they came up with the thing itself. Who's crazy now? If you want to read the future, read the comics. They all come true. If a mind can produce the idea, a mind can make it work."

WASTE IS SABOTAGE!

ARE YOU DOING ALL YOU CAN TO AVOID IT IN YOUR BOILER PLANT?

Fuel is a vital weapon of war. It is imperative that boiler plants fired with fuel oil, transfer every last heat unit to useful power or heat.

To make sure that your heat or power plant is delivering all the steam of which it is capable with the least possible fuel consumption . . . check your operation against the ten points listed opposite.

- ✓ **All mechanical parts of burners should be kept clean and in good operating condition. Worn parts should be promptly replaced. Keeping equipment in good condition will save you many times over the cost of replacements.**
- ✓ **Temperature of oil supplied to burners should be watched carefully. Bunker "C" or No. 6 oil should be supplied to burners at a viscosity of 150 SSU for best atomization.**
- ✓ **Atomizers should be properly adjusted for best position with relation to air register throat.**
- ✓ **No more air than is absolutely necessary for complete combustion of the fuel without objectionable smoke should ever be supplied to the burners. If at all possible a recording flue-gas analyzer should be installed. If a recording analyzer is not installed, frequent analysis of combustion gases should be made with a hand analyzer.**
- ✓ **The fire side and water side of boiler surfaces should be kept clean, as soot on the first and scale on the second will reduce boiler efficiency. A definite schedule for cleaning tubes should be established.**
- ✓ **Uptake gas temperature should be checked against boiler manufacturer's guarantees. Too high a temperature in the uptake is usually an indication of a dirty boiler.**
- ✓ **Boiler baffles should be maintained in good condition. Leakage through baffles will allow partial short-circuiting of the gases, which will also cause a high exit gas temperature.**
- ✓ **Boiler settings, tube doors, explosion doors and boiler entrance doors should be kept airtight. Infiltration of air through any of these parts causes a serious loss in efficiency.**
- ✓ **Test checks should be made frequently on the overall efficiency of the boiler plant.**
- ✓ **Auxiliary equipment such as feed water heaters, pumps, etc., should be maintained in the best possible condition.**

TODD SHIPYARDS CORPORATION

TODD COMBUSTION DIVISION

601 West 26th Street, New York 1, N. Y.

NEW YORK · MOBILE · NEW ORLEANS · GALVESTON
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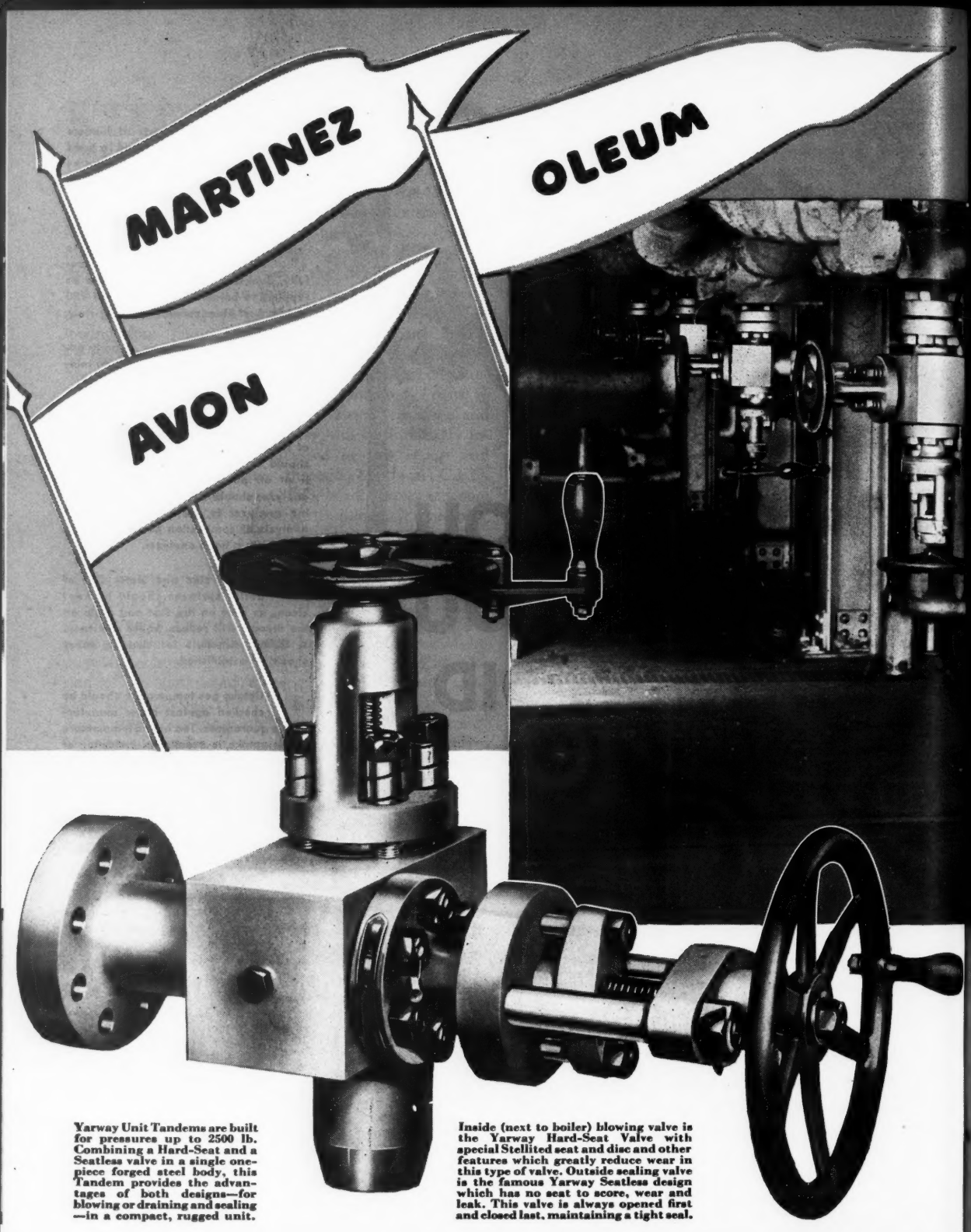
TODD BURNERS ★ ★ ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

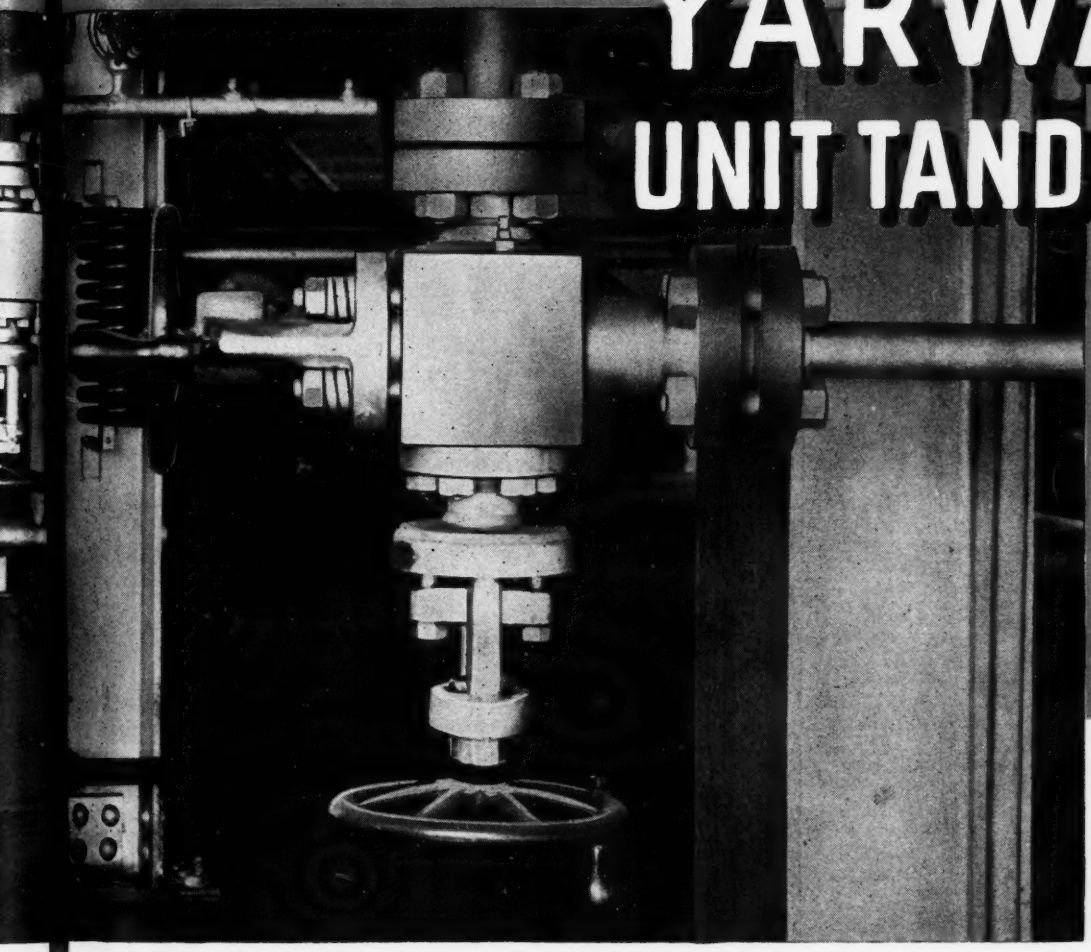


Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—for blowing or draining and sealing—in a compact, rugged unit.

Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve with special Stellited seat and disc and other features which greatly reduce wear in this type of valve. Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This valve is always opened first and closed last, maintaining a tight seal.

YARWAY

All Three of These Pacific Gas & Electric Co. High Pressure Stations Completely Equipped with YARWAY UNIT TANDEMS



THREE more in the long list of modern, high pressure generating stations to select Yarway Unit Tandem Blow-Off Valves — the 1500 lb Martinez, Avon and Oleum Stations of the Pacific Gas and Electric Co.

The illustration shows five of the six Yarway Unit Tandems in use on water wall drains and boiler blow down lines at Martinez Station. All together, there are 24 High Pressure Yarway Unit Tandems in use in the three plants. 80% of the leading high pressure utility and industrial plants have selected Yarway Tandem Blow-Off Valves.

Years of service have proved the sound design and metallurgy of these valves for blowing down or draining and sealing. Such records as—"3000 blows at pressures of more than 1300 psi without a single replacement of parts or repairs of any nature"—have made the Yarway Unit Tandem the outstanding preference for high pressure service today

What are your draining and blow down requirements? Write for Catalog. Section B-431 for pressures up to 2500 lb; section B-422 for lower pressures.

YARNALL-WARING COMPANY
114 Mermaid Avenue, Philadelphia, Pa.

BLOW-OFF VALVES

Save HEATING TIME

...to speed up Production

Hotter Iro
ARMSTRONG UNIT TRAPPING SPEEDS UP BED SPREAD IRONING RATE 150% IN MAYO HOTEL LAUNDRY
ttsburgh
Productio
Cut Cooking Time 75% For Soybean P
Canning Plant Speeds Up Cooking Kettles 30%
MODERNIZATI
Save Two Hours' Work Per Day at Tire Mold
Unit Trapping
Six-Ro
STEAM CONSUMPTION CUT 47.5%; TEMPER RAISED 70°
40%
FASTER HEATING
Of reports that have been turned in over the past 13 years dealing with faster heating secured by Armstrong trapping, those that give figures show an average speed up of 40%!
ARMSTRONG
"INVERTED BUCKET"
STEAM TRAP

WITH time, fuel, manpower and industrial equipment all at a premium, it is vitally important that no method of speeding up production be overlooked.

Heating time on steam-jacketed equipment, unit heaters, dryer rolls, cookers, evaporators, and other heating and process units, can often be cut a surprising degree by Armstrong Unit Trapping.

Automatic Air Elimination—Air in heating units, dryers and other process equipment dilutes steam, reduces its temperature and impedes heat transfer. Armstrong Traps speed up heating by eliminating air automatically along with the condensate.

Automatic Condensate Drainage—Sluggish condensate elimination slows up heating. Armstrong Traps remove condensate as fast as it accumulates and under all load conditions, without steam loss. Steam saving means fuel saving.

ARMSTRONG MACHINE WORKS
810 Maple St. • Three Rivers, Michigan

Armstrong STEAM TRAPS

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Have You a Tough Grease Problem?

HOW TO SOLVE Operating Problems with *Correct Lubrication*

JUST LOOK AT SOME OF THE OPERATING CONDITIONS SPECIAL GARGOYLE GREASES ARE LICKING. THE EXPERIENCE THAT DEVELOPED THESE GREASES IS AVAILABLE TO YOU...

HIGH TEMPERATURE	**OVER 400° F.**		**Gargoyle Grease BRB4 Gargoyle Sovarex Grease**
EXCESSIVE WATER	**WATER-FLOODED BEARINGS**		**Gargoyle Grease AA Gargoyle Sovarex Grease**
EXTREME SPEEDS	**20,000 TO 50,000 R.P.M.**		**Gargoyle Grease BRB4 (for ball bearings)**
HIGH PRESSURES	**MEETS MOST SEVERE STEEL MILL USE**		**Gargoyle Grease Sovarex L**
LOW TEMPERATURE	**−40° F.**		**Gargoyle Mobilgrease Zero**
WIDE TEMPERATURE RANGE	**+250° F. TO −60° F.**		**[Name on Request]**

IF YOU are responsible for the operation of any machines or equipment that are grease-lubricated—*be sure you've heard the Gargoyle Grease story!*

There is available to you the same full line...the same high quality in Gargoyle *Greases* that you have learned to depend upon in Gargoyle *Oils.*

And they are sold on the same basis i.e. *their use will bring you benefits in power and maintenance economies...and in full time, capacity production!*

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GARGOYLE Lubricants

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

HEADQUARTERS FOR GREASES TO MEET EVERY PROBLEM—

SOCONY-VACUUM

B. t. u. Savers

CO_2 METERS

An Automatic Orsat—For Checking Combustion Efficiency

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. Less than this amount indicates an excess of combustion air, causing high stack loss. The CO_2 meter is the only method of accurately determining combustion efficiency.

WRITE FOR DATA BOOK No. 403

RECORDING THERMOMETER

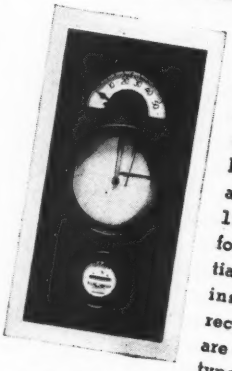
Remote Reading—Single and Multiple Pen

Republic thermometers are available for recording temperature of flue gas, temperatures in vats or tanks either open or closed and under pressure, temperatures in pipe lines, refrigeration systems, ovens, kilns or ducts. For unusual conditions, special bulbs are furnished of corrosion resisting metal or with a protective coating.

WRITE FOR DATA BOOK No. 210

FLOW METERS

Electrical Remote Reading Type



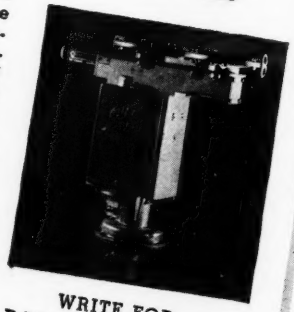
Republic electrical type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 10,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator — are of the remote reading type.

WRITE FOR DATA BOOK No. 701

REGULATORS

Pressure—Flow—Speed—Level—Ratio

Republic hydraulic or pneumatic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.

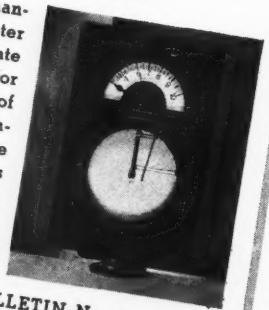


WRITE FOR DATA BOOK No. S-13

FLOW METERS

Mechanical Float Type

The Republic mechanical float type meter is a simple, accurate metering device for measuring the flow of steam, water, gas, compressed air, oil, brine and other fluids. It has been designed primarily for installations where remote registration is not required.

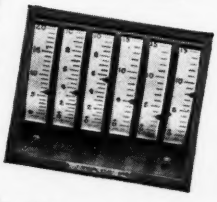


WRITE FOR BULLETIN No. 312

DRAFT AND PRESSURE INSTRUMENTS

Diaphragm Actuated Any Number and Combination

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic dry-bellows type indicators and recorders are supplied for all ranges encountered in furnace operation in any desired combination.



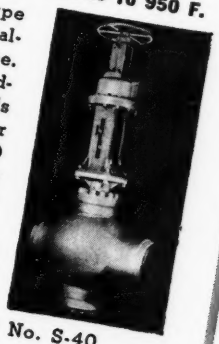
WRITE FOR BULLETIN No. 802

that will help you stretch wartime plant capacity

PRESSURE REDUCING AND REGULATING VALVES

Pressure To 2500 lb.—Temperatures To 950 F.

Republic turbine type valves are of the gradual-opening, high-lift type. They are built in accordance with A.S.A. standards and can be supplied for all pressures up to 2500 lb. per sq. in. and for temperatures up to 950 F and for any specified capacity. Republic valves will regulate down to 2% of maximum flow.

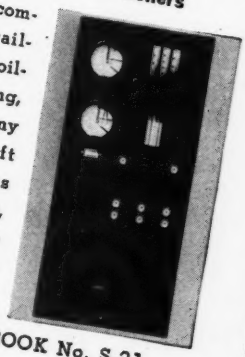


WRITE FOR BULLETIN No. S-40

COMBUSTION CONTROL

For All Sizes and Types of Boilers

Republic automatic combustion control is available for all sizes of boilers, all types of fuel firing, all load conditions and any arrangement of draft equipment. It maintains constant steam pressure, highest combustion efficiency, desired load division, constant furnace draft.



WRITE FOR DATA BOOK No. S-21

DESUPERHEATERS

Built To Meet Your Specific Requirements

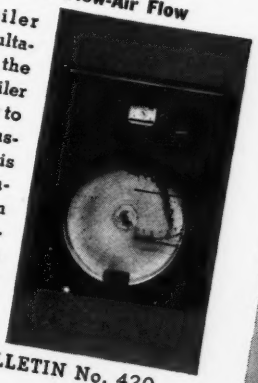
Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters. These are of the venturi type, with ratio or ratio-tank control, the steam atomizing type and the mechanical atomizing type.

WRITE FOR DATA BOOK No. S-35

BOILER METERS

Record Steam Flow-Air Flow

The Republic Boiler Meter records simultaneously on one chart the steam flow from the boiler and the rate of air flow to the furnace for combustion. The air flow pen is adjusted to record coincident with the steam flow pen when the furnace is receiving the proper amount of air for maximum combustion efficiency.



WRITE FOR BULLETIN No. 420

REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Flow Meters Co.

222 Diversey Parkway · Chicago 47, Illinois

For 20 stirring years . . .

MAJOR "FIRSTS" FOR HALL LABORATORIES

1922
Castor oil, potato peelings, flaxseed meal and wheat chaff held no magic.

1922 When "experts" solemnly guessed that boiler scale was formed by sludge baking onto boiler surfaces—

Hagan Corporation began the first physical-chemical investigation to find out how ***and*** why ***scale actually formed.***

1923 When most chemists investigating water problems went no further than laboratory tests in beakers—

Hagan Cooperative Research proved by a 42-day chemical balance on an operating boiler that boiler scale formed in place on the heat-transfer surface.

1924 When costly "boiler compounds" with allegedly marvelous properties but secret compositions were used hit-or-miss—

Hagan Cooperative Research made the use of standard chemicals—soda ash and sodium orthophosphates — effective by controlling chemical equilibria in the boiler.

1926 When others engaged in boiler-water treatment jealously guarded their bits of technical knowledge—

Hall Laboratories, newly formed subsidiary of Hagan Corporation, blazed a trail, "telling the world" in technical detail precisely how to maintain proper boiler-water conditions.

1930 When conditioning of boiler water with orthophosphate according to the principle of chemical equilibrium was slowly gaining general recognition—

Hall Laboratories explored the undeveloped field of the molecularly dehydrated phosphates, lifted sodium phosphate glass from scientific obscurity to practical use as the most useful and versatile phosphate for water conditioning.

1931 When the sulphate-alkalinity ratios for preventing embrittlement were accepted blindly or criticized bitterly—

Hall Laboratories initiated the raising of funds for a cooperative investigation to find out how sodium sulphate actually behaved.

FIRST to find the answers to boiler water problems

BACK in the early twenties boiler-water medicine men with their strange, costly and ineffective remedies were still in their hey day. Neither they nor anyone else knew *how* or *why* boiler scale was formed. But every power plant engineer knew what it was doing to his boilers and was desperate for a remedy.

How that remedy came, through the determination of engineers who had pioneered HAGAN AUTOMATIC COMBUSTION CONTROL, is now steam power history. They saw the futility of stepping up steam production if the benefits were to continue to be offset by boiler failure due to scale and resolved to do something about it.

In 1922 they set out to find the answer by means of a cooperative investigation with the U. S. Bureau of Mines. R. E. Hall, physical chemist of the Bureau, was placed in charge. Then began to unfold a drama which during the more than twenty years since, has resulted in one revolutionary FIRST after another. By utilizing the practical judgment of the engineer in applying the advanced thinking of the physical chemist, Hall Laboratories has consistently stood forth as a pioneer in water conditioning.

We sincerely believe that no other institution in the world can offer you the accumulated knowledge and experience, or the complete service for efficient, maintenance-free, economical power plant operation, which we have made our specialty.

1933 When softened water could be obtained only by distillation, by precipitation of hardness, or by base exchange—

Hall Laboratories added a new fourth way—sequestration of calcium and magnesium ions in a soluble complex by means of sodium phosphate glass.

1938 When attention was concentrated on reducing dissolved oxygen in boiler feed water to 1 part or less in 100 million to prevent corrosion of tubes—

Hall Laboratories showed that steel in high-duty tubes was being oxidized away, not by infinitesimal amounts of dissolved oxygen, but by the 0.89 pound of oxygen combined in each pound of boiler water.

1942 When technical talent was concentrated on removing silica from boiler feed water to obviate siliceous deposits in boilers and turbines—

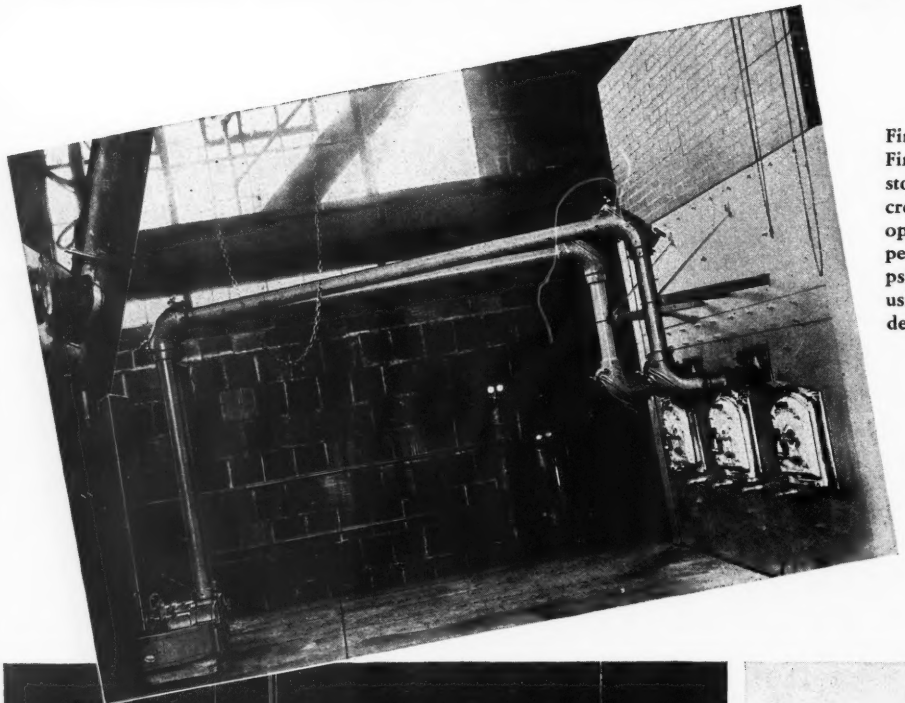
Hall Laboratories carried into the stage of actual full-scale plant operation a new development, the findings from which—as spectacular in their benefits as any in the whole history of boiler-water conditioning — will be announced in the near future.

HALL SYSTEM of Boiler Water Conditioning

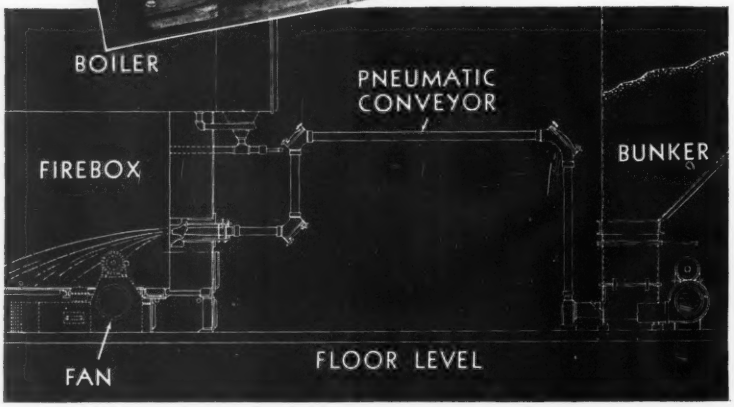
HAGAN HALL BUROMIN CALGON

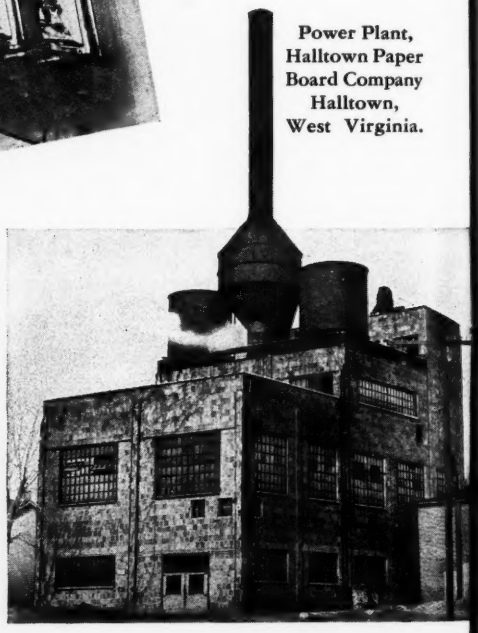
HALL LABORATORIES, INC.
A subsidiary of Hagan Corporation
Hagan Building, Pittsburgh, 30, Pa.

IRON FIREMAN "Spreaders"



First installation of two Iron Fireman Pneumatic Spreader stokers, which fire 394 h.p. cross drum boilers. The boilers operate at approximately 200 per cent of rating, carrying 300 psi with 150 degree superheat, using preheated air at 350 degrees under the grates.





Power Plant, Halltown Paper Board Company Halltown, West Virginia.

35,000 Pounds of Steam Per Hour Produced During Peak Loads

Two Iron Fireman Pneumatic Spreader stokers serve two 394 h. p. straight tube boilers and operate at 1000 h. p. during peak loads. This is an output of 35,000 lbs. of steam per hour per boiler. The boiler pressure is 300 psi; superheating brings the steam temperature up to 650 degrees. An air preheater is installed which raises the temperature of the combustion air up to approximately 350 degrees. This installation at Halltown Paper has reduced auxiliary power cost and maintenance cost. Steam cost has been reduced from $.235 to $.18.

FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3521 W. 106th Street, Cleveland, Ohio.

Save Halltown Paper Board Co. Over $12,000 a Year

★ Burn Low Grade Coal with High Efficiency ★

• Because Iron Fireman Pneumatic Spreader stokers burn lower-grade coals, Halltown Paper Board Company installed them to replace multiple retort underfeed stokers of another type. Fuel savings alone have been remarkable—over $12,000 a year. These savings have liquidated the investment in less than three years.

This performance is typical of what Iron Fireman firing is doing in tens of thousands of boiler rooms. Iron Fireman automatic coal stokers, in addition to cutting fuel costs drastically, are increasing steam output 10 to 35 per cent—and are burning coal—a plentiful fuel.

How the P. S. Stoker Achieves its Remarkable Results

The Iron Fireman Pneumatic Spreader conveys steam size coal from the hopper or main coal bunker to a transfer housing, where the coal is picked up by a stream of air and conveyed to the furnace and grates. The fines burn in suspension, utilizing the conveying air for combustion. The larger pieces form a shallow fuel bed on the grate. By means of an adjustable nozzle, the coal is dropped by gravity and *distributed uniformly over the entire surface of the grates.*

The conveying air provides the overfire air which is, of course, a requisite of efficient combustion. This air is more intimately mixed with the coal than is possible by any other means. Entering at right angles to the flow of undergrate air through the fuel bed, the conveying air produces *maximum turbulence.* This conveying air, which has been heated by contact with furnace gases, preheats the coal before it enters the furnace. This results in rapid ignition and highly efficient combustion.

Applications are flexible; the stoker can be set at boiler room floor level, or on the floor above or below. It can be located at any angle in front of the boiler, and at distances of 30 feet or more from the boiler front.

The Iron Fireman Pneumatic Spreader stoker was designed to burn efficiently a wide range of such economical fuels as the lower-grade bituminous coals, and also sub-bituminous and lignite coals, and to provide *a reliability of operation, physical adaptability, ease of operation,* and *low maintenance* not afforded by other types of automatic coal burning systems.

Iron Fireman Stokers are Available. Write for Information

Output of Iron Fireman commercial and industrial stokers has been substantially increased to equip heating and power plants converting from oil, hand-fired coal and gas. Our nationwide organization of qualified factory representatives and dealers is at your service. Write for literature. Iron Fireman Manufacturing Company, 3521 West 106th Street, Cleveland 11, Ohio.

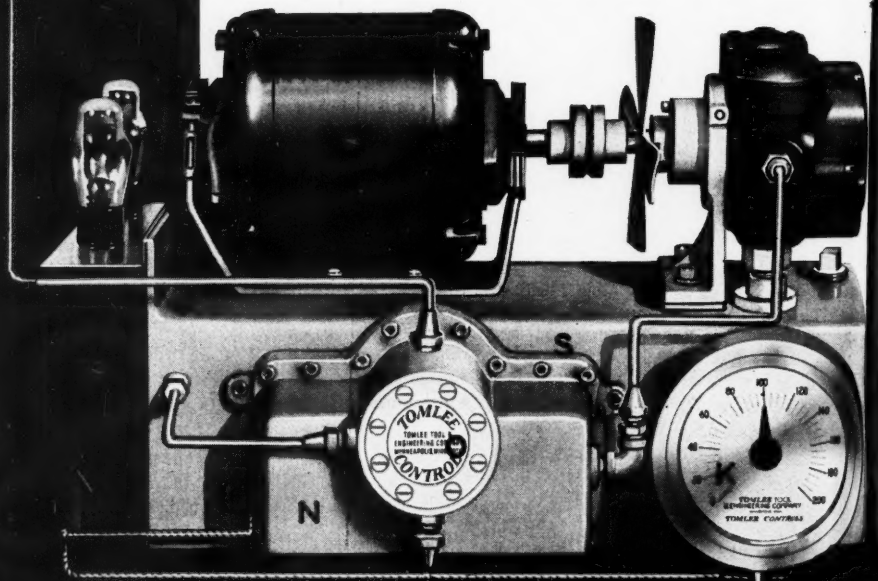
IRON FIREMAN

THE IRON FIREMAN

Automatic Coal Stokers

HOW THI
Electronic Contro Sy
When Applied t H
and Saves Up t 20

Here, in the Tomlee Electronic Control System you have a method of control and regulation of time, temperature, pressure, flow and quantity that is the very ultimate in practicality ... It is a combination of electronic, electrical, hydraulic and mechanical action so well coordinated and so precisely designed that feeble, minute impulses are transmitted into mechanical action with the speed of light ... It will record, regulate and control variations in any pre-set value in milliseconds, totally eliminating "lag" and "hunting," and thereby preventing the accumulation of repeated errors which affect the quality of a product, cause waste of time and increased processing and fuel costs ... Read the opposite page carefully ... It explains how the system functions in improving the efficiency of a heating system and reduces fuel costs up to 20%.

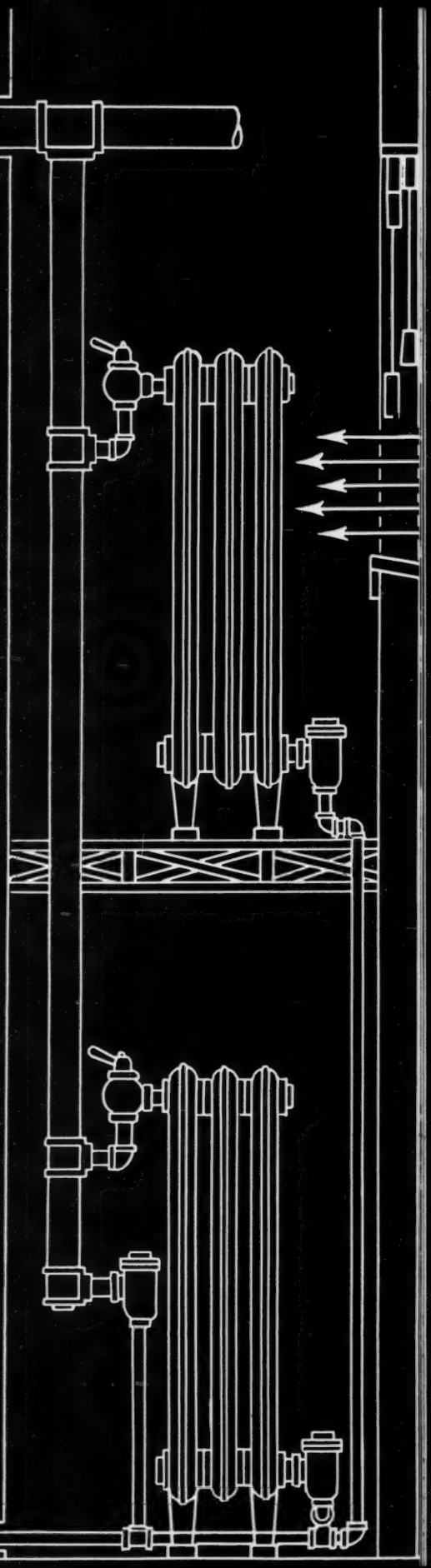


TOMLEE

System Functions

Heating Problem

20% in Fuel Costs



Though not generally acknowledged, excessive fuel costs are frequently traceable to the inefficient utilization of the steam generated rather than to any inefficiencies in the generation of the steam. Steam generated in a high-pressure boiler, reduced through a reducing valve to the low pressure necessary to supply the demand, viz. 5 lbs., is held to exactly that pressure.

As changes in the condensing rate take place in any part of the system, minute changes in pressure also take place. These are instantaneously compensated for in the sequence following.

As minute variations in pressure occur at impulse tube (I), they are transmitted to the extremely sensitive element (K). These minute variations open or close a contact in (K) which operates on only .2 milliamperes of current. This feeble current operates tubes (L) in Flashtron Unit (M), which cause either one of two solenoids located in housing (N) to operate four-way valve (O), which turns a maximum of 11 degrees in either a clockwise or counter-clockwise direction, forcing oil under pressure through hydraulic lines (P) and (Q). This hydraulic pressure operates a piston in hydraulic unit (R) which in turn proportions reducing valve (C), thereby causing the valve to literally float on a cushion of live steam, constantly responsive to the most minute variations in the low-pressure side of the system and maintaining the value pre-set by adjusting sensitive unit (K).

It is obvious that as more rapid condensation takes place in radiator (E) than in radiator (F) and consequently more steam being required in radiator (E), impulse will occur in impulse tube (I); and conversely, when higher condensation in radiator (E) has been compensated for, impulses in tube (I) will immediately act to reduce the volume of steam flowing through reducing valve (C), maintaining the value originally pre-set in sensitive element (K).

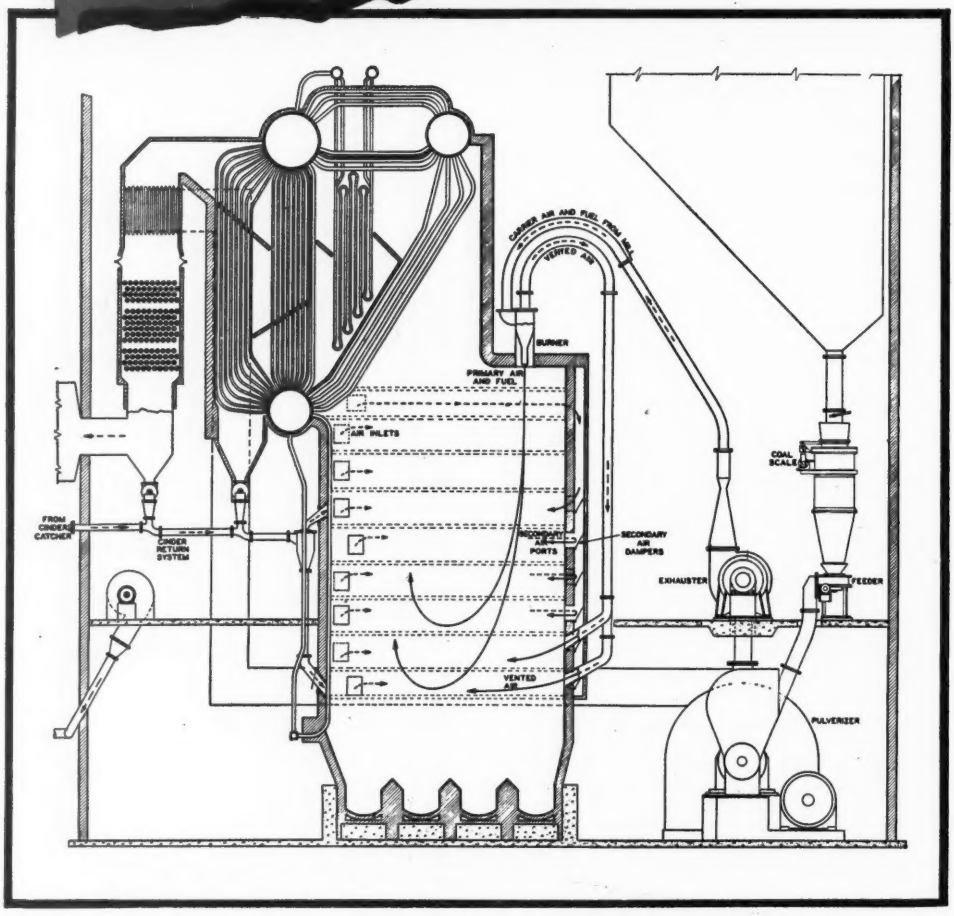
While the application described and illustrated here has to do specifically with a heating problem, the advantages of Tomlee Electronic Control System are equally applicable to process control or wherever control and regulation of time, temperature, pressure, quantity or flow is involved.

The Tomlee Electronic Control System is the product of a company highly skilled in the manufacture of precision apparatus.

This company is in a position to make specific recommendations covering the application of this system to practically any control problem. Write for complete information. TOMLEE TOOL & ENGINEERING COMPANY, 253 Third Avenue, South, Minneapolis 15, Minnesota.

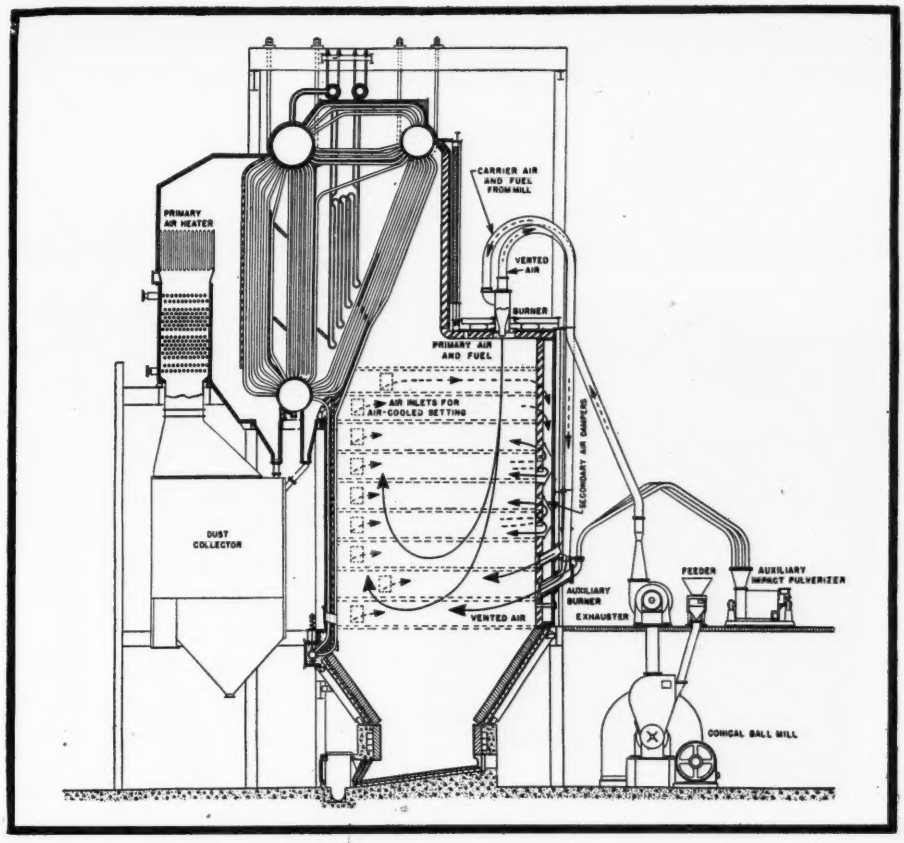
TOMLEE

20-50% SAVED BURNING ANTHRACITE FINES



This 150,000 lb. per hour steam generator operating on low cost anthracite saves 50% of fuel costs of bituminous required for the same rating.

FOSTER



Sectional drawing of a 175,000 lb. per hr. high efficiency steam generator which operates on pulverized anthracite. This is one of 2 duplicate units recently installed in a large Eastern paper mill.

● Three steam generators fired with pulverized anthracite have been continuously operated for several years in two prominent boiler plants. Fuel costs of the unit located nearer the anthracite fields are 50% less than if bituminous was fired, while the other installment, situated at greater distance from the mines, effects a corresponding saving of 20%.

For many years "bin" storage systems were necessary adjuncts when burning pulverized anthracite. Fuel characteristics plus limitations in the pulverizing equipment made these complex and expensive applications necessary for safe and continuous operations.

Then came the Foster Wheeler "unit" system for pulverized anthracite. Specially designed pulverizers, burners, furnaces, boilers, superheaters and heat recovery equipment were all integrated into a single unit to pulverize and fire anthracite continuously and as required. "Bin" storage was eliminated and the new installations showed a continuous record of high efficiency, low maintenance and stable furnace conditions under fluctuating loads. The first unit has now pulverized, in highly successful operation, 225,000 tons of anthracite having an average Btu value of 10,500 and average ash content of 15%.

For more than seven years pulverized anthracite has been successfully fired in Foster Wheeler "unit systems". Commercial operating records of the seven units already in service show uniformly economic and efficient performance.

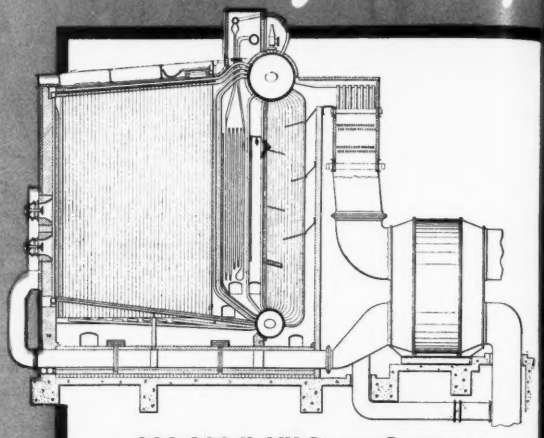
FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.

WHEELER

COMBUSTION ENGINEERING'S VU AND

are suitable for any

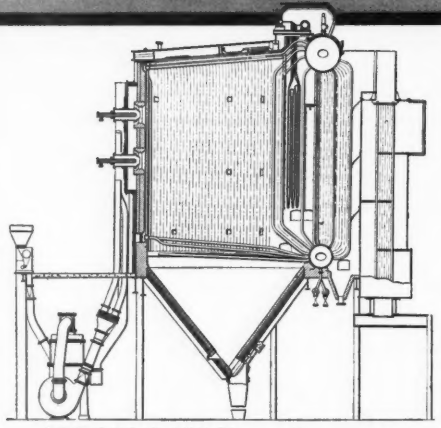
CAPACITIES
from 15,000
to 300,000
lb of steam per hr



300,000 lb VU Steam Generator oil-fired

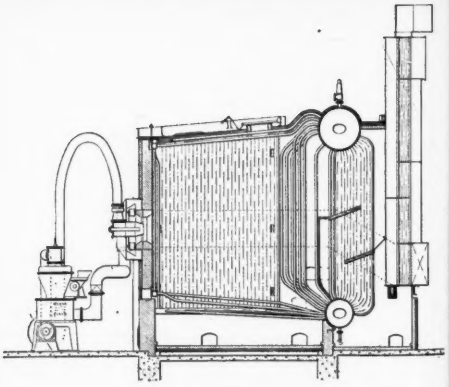
A semi-outdoor installation for a large southern public utility. Includes an Elesco Interbank Superheater and an Elesco Fin Tube Economizer. Design pressure—1000 psi. Total steam temp.—905 F.

Pulverized Coal, Oil, Gas Firing



150,000 lb VU Steam Generator pulverized coal or natural gas-fired

Installation of a mid-west transportation company. Includes Elesco Superheater and Tubular Air Heater. Firing equipment consists of C-E Raymond Bowl Mills and C-E Type R Burners. Design pressure—475 psi. Total steam temp.—735 F.



60,000 lb VU Steam Generator pulverized coal or oil-fired

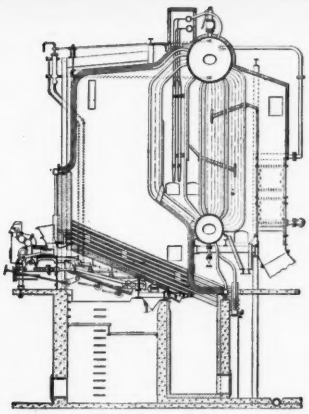
Installation of a southern textile mill. Firing equipment consists of C-E Raymond Bowl Mill and C-E Type R Burner. Design pressure—300 psi. No superheat.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION

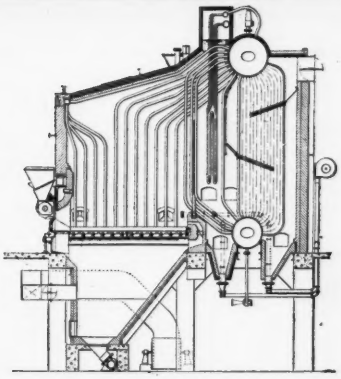
VU-Z STEAM GENERATORS

fuel or method of firing



70,000 lb VU-Z Steam Generator with C-E Multiple Retort Stoker

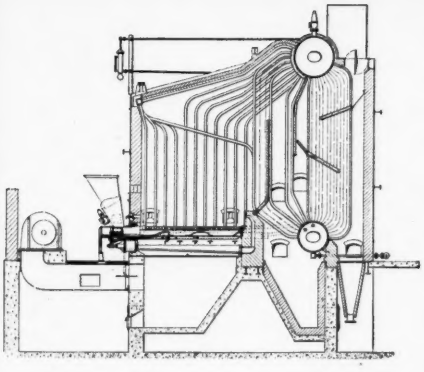
Installation of a large southern utility. Includes Elesco Interbank Superheater and Elesco Fin Tube Economizer. Design press.—250 psi. Total steam temp.—510 F.



38,800 lb VU-Z Steam Generator with C-E Spreader Stoker

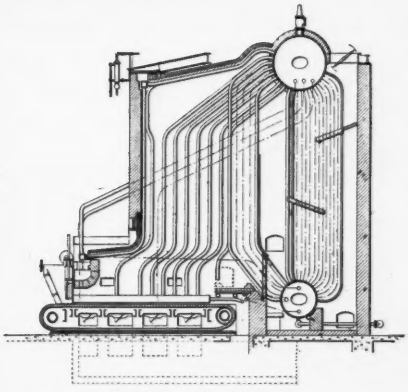
One of three VU-Z Units installed by a mid-west cement plant. Included are Elesco Interbank Superheaters. All three are fired by C-E Spreader Stokers. Design pressure—275 psi. Total steam temp.—468 F.

Various Types of Stoker Firing



35,000 lb VU-Z Steam Generator with C-E Type E Stoker

Installation of an eastern oil equipment manufacturer. Design pressure—200 psi. No superheat.



35,000 lb VU-Z Steam Generator with C-E Chain Grate Stoker

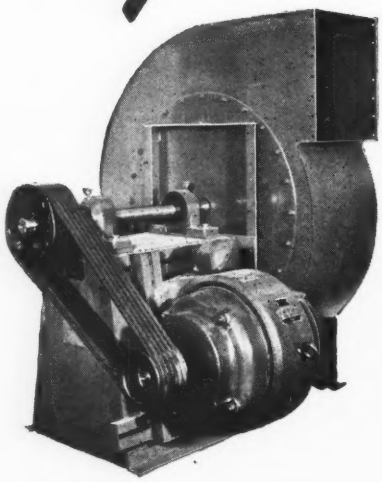
Installation for a mid-west confectionery plant. Design pressure—200 psi. No superheat.

COMBUSTION ENGINEERING COMPANY, INC., 200 MADISON AVENUE, NEW YORK, N. Y. • CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

COMBUSTION ENGINEERING

A-681

Progress and Power in the



American Blower general purpose industrial Type E exhauster.

No basic industry in America has been called upon to bear a heavier war burden than the great Aluminum Industry. From the early days of cash-and-carry, aluminum producers have worked shoulder to shoulder with America's electric power producers to help build the weapons and machines which are today's assurance of Victory.

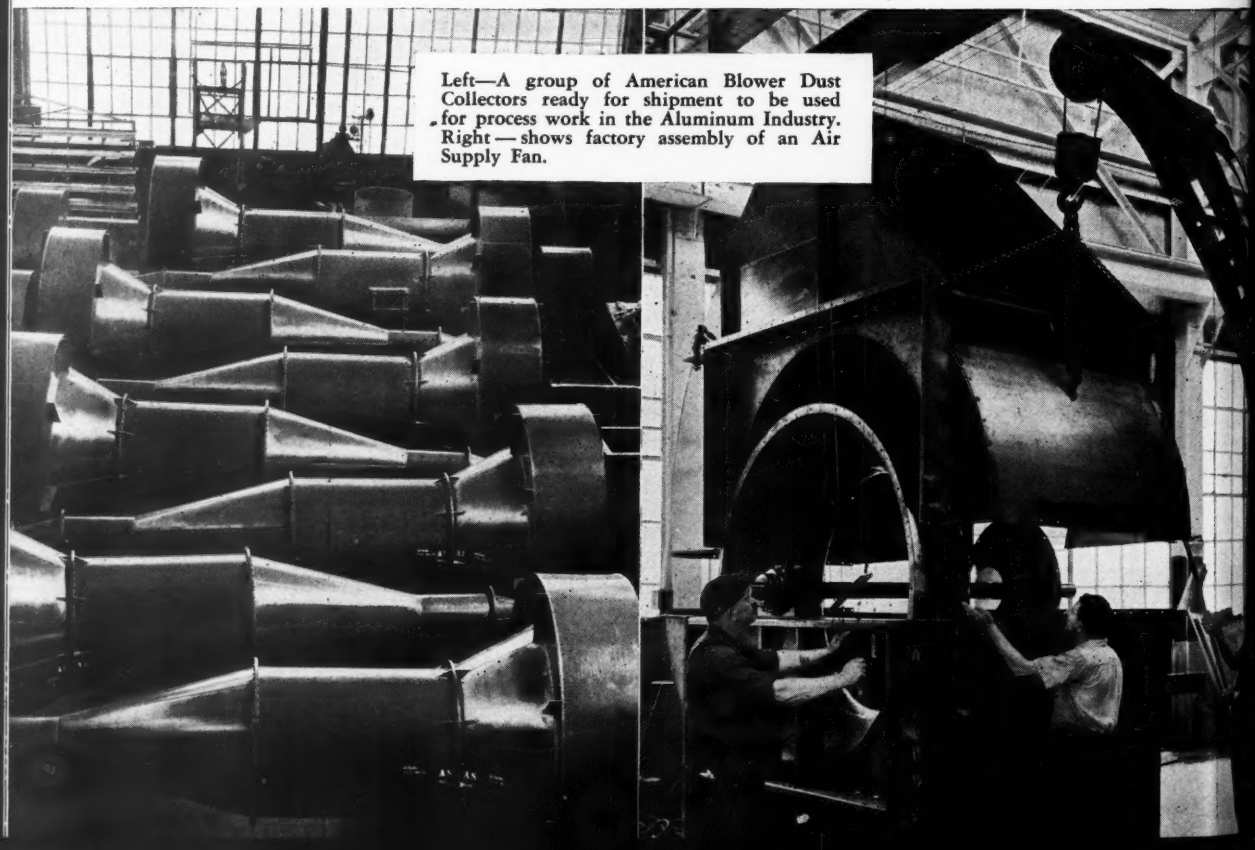
In the power plants, too, which supply America's countless war industries, American Blower Mechanical Draft Fans and Fluid Drives are helping set new peak records of electric energy output.

After Victory, American Blower will be in a position to supply the Public Utilities and all other industries with an ever increasing amount of mechanical draft equipment, heating, ventilating, dust collecting equipment and Fluid Drives.

ARMY E NAVY
For Production "Well Done"

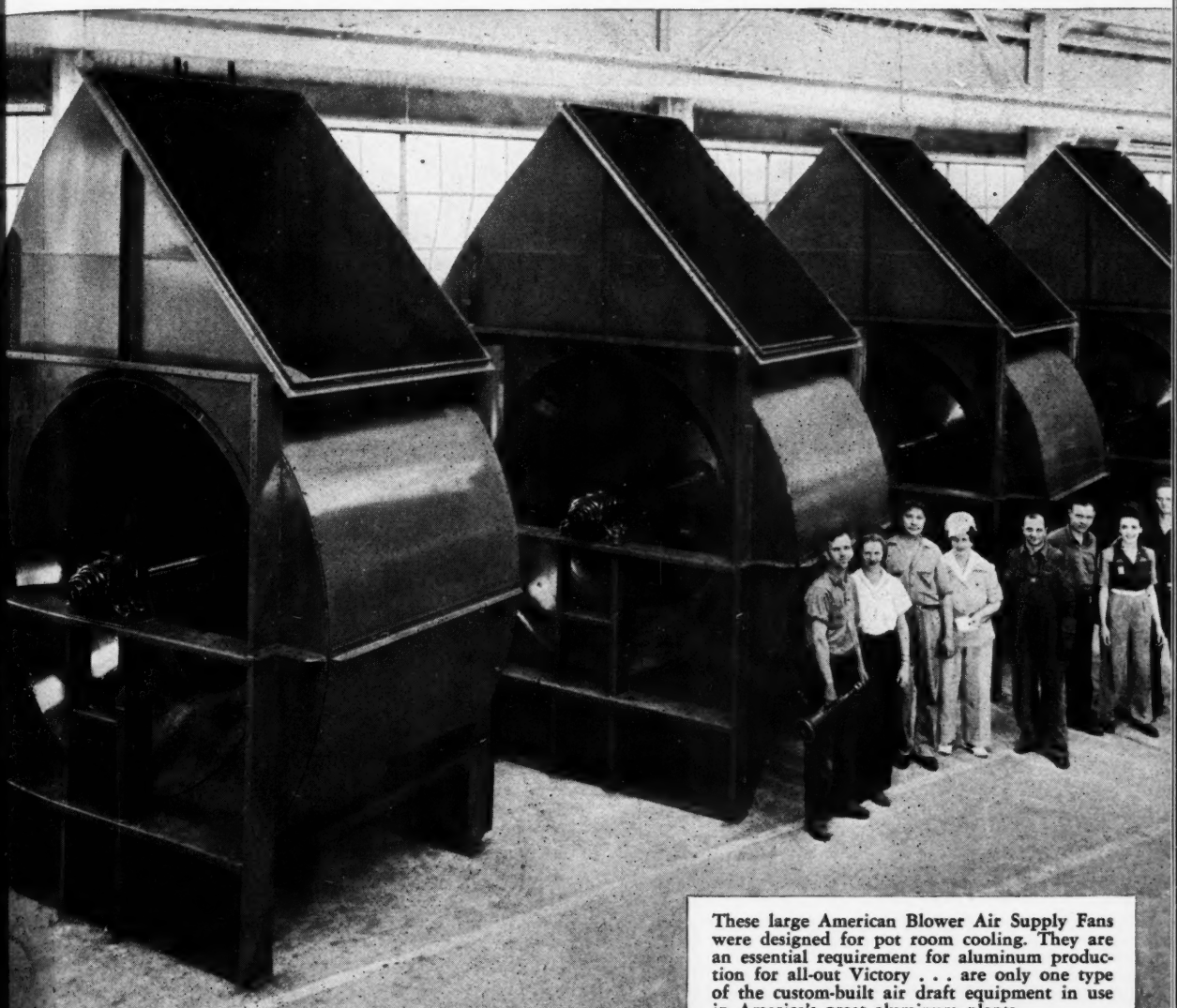
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN Radiator and Standard Sanitary Corporation



Left—A group of American Blower Dust Collectors ready for shipment to be used for process work in the Aluminum Industry. Right — shows factory assembly of an Air Supply Fan.

ALUMINUM INDUSTRY



These large American Blower Air Supply Fans were designed for pot room cooling. They are an essential requirement for aluminum production for all-out Victory . . . are only one type of the custom-built air draft equipment in use in America's great aluminum plants.

A battery of special Purifiers, under construction at one of American Blower's three great plants, for air purification and cooling electrical equipment in the Aluminum Industry.

The TERRY

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

— The Terry wheel will withstand abuse that would wreck any built up wheel.

THE TERRY STEAM TURBINE CO.

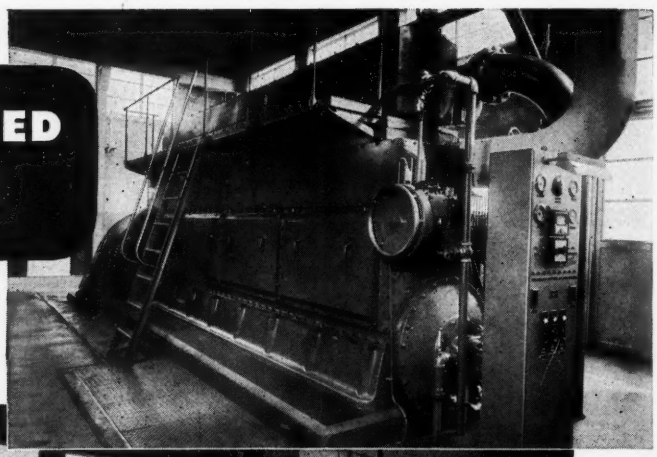
Wheel Turbine

At right—
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized

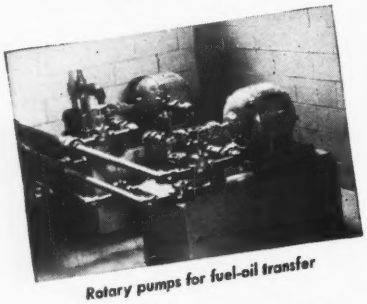
T-1147

TERRY SQUARE - HARTFORD, CONN.

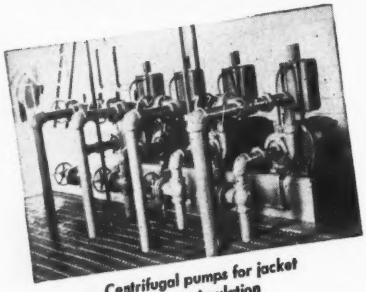
FOR UNINTERRUPTED POWER SERVICE



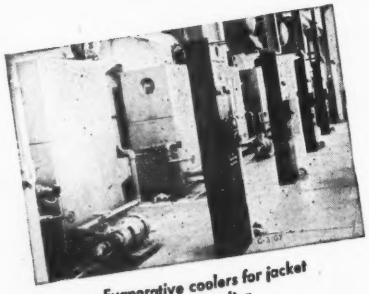
Air compressors for starting



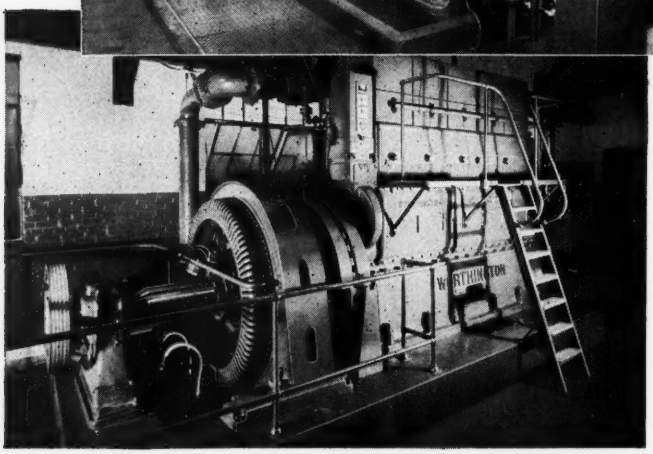
Rotary pumps for fuel-oil transfer



Centrifugal pumps for jacket water circulation



Evaporative coolers for jacket water cooling



The outstanding reliability of Worthington diesel and gas engines is a matter of definite record in hundreds of installations, and in a wide variety of applications. They are giving unbroken performance—with high operating efficiency—over long periods of continuous service.

And, all Worthington auxiliaries . . . air compressors for starting, rotary pumps for fuel-oil transfer, centrifugal pumps for jacket water circulation and evaporative coolers for jacket water cooling . . . give additional service security through the undivided responsibility of one maker.

●

Thousands of horsepower of Worthington engines . . . in Army and Navy bases, ordnance plants, industrial and municipal power plants . . . are now carrying important parts of the United Nations' war power load.

DIESEL ENGINES
150 to 1500 hp.

GAS ENGINES
175 to 2880 hp.

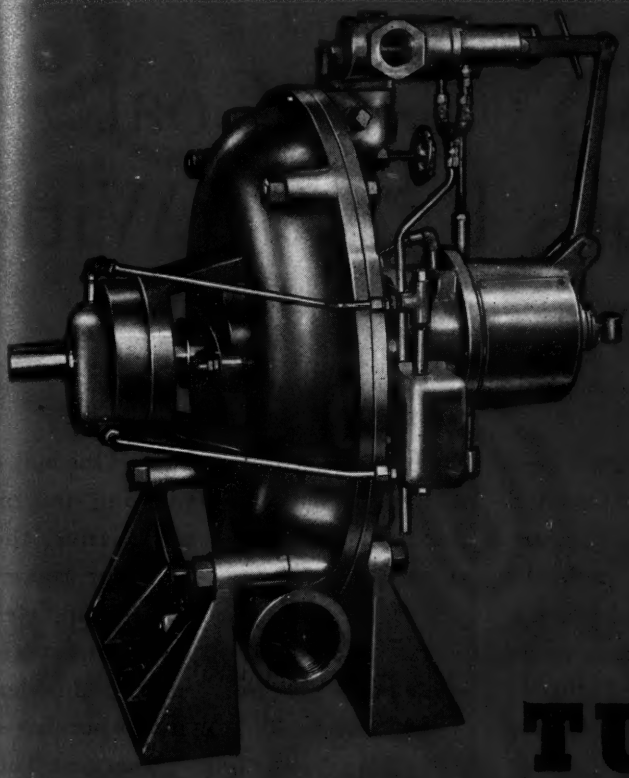
CONVERTIBLE GAS-DIESEL ENGINES
150 to 1500 hp.

TO ALL YOUR WORTHINGTON PLANTS FOR EXCELLENCE IN WAR PRODUCTION

DE3-10

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY



AN ECONOMICAL DEPENDABLE SOURCE OF POWER

WING STEAM TURBINES

For over sixty years the WING Steam Turbine has been delivering dependable, economical power in the operation of fans, blowers, pumps and other auxiliary drive equipment. Today's exacting requirements find Wing Turbines taking their place in the War effort with the same efficiency that has marked their peacetime contribution to industry.

L. J. Wing Mfg. Co.

7th Ave. & W. 14th Street, New York 11, N. Y.
Factories: Newark, N. J. Montreal, Canada

Partial shipment on order of 250 WING STEAM TURBINES

WING

HEATING, VENTILATING AND COMBUSTION EQUIPMENT

Seesaw "Coal-oil-Coal" Conversions End Up With TAYLOR STOKERS

ALMOST 20 years ago in 1924, a certain New England plant installed two Taylor Stoker fired boilers. The performance of the stokers was perfectly satisfactory... but, after several years, a favorable turn in fuel oil prices made permanent conversion to oil firing seem logically and economically advisable. So the stokers were removed.

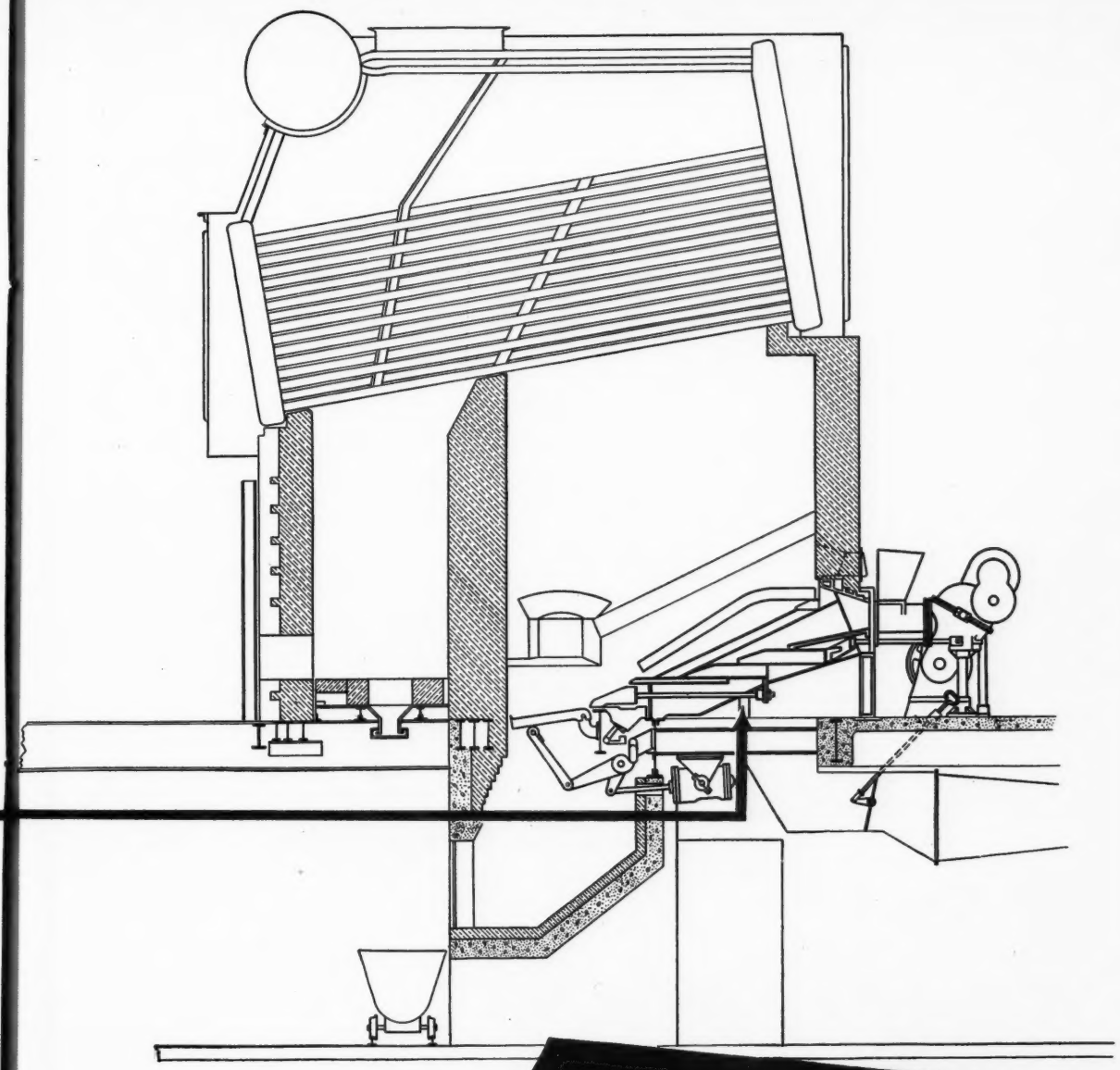
Then, a few years ago, coal again became economically available. One boiler was reconverted to coal firing and, on the strength of past experience, the reconversion included a Taylor Stoker. Hardly had this step been completed when war and fuel oil restrictions necessitated changing over the second boiler. The second Taylor Stoker was purchased early this year and is now in service. This plant KNOWS what Taylor Stokers can do!

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward ... quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE** — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



A-E-CO TAYLOR STOKERS
LO-HED HOISTS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

A-E-CO
TAYLOR STOKER

COMPANY

AE CO 75th ANNIVERSARY

...if we'll do ours!

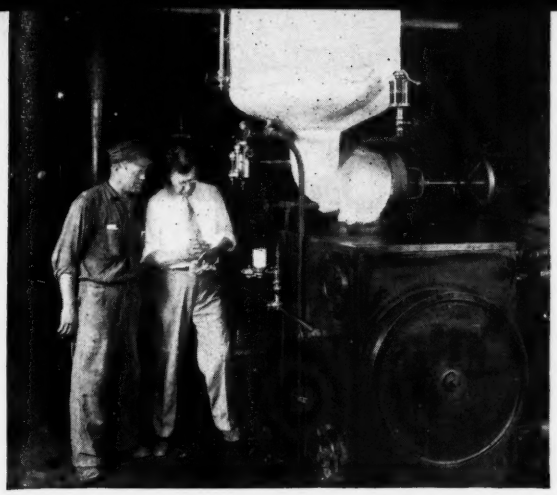
Garlock

Our fighting men are giving 'em the works—and they'll keep it up until Victory is won. But they're depending on us to do *our* job on the home front. They are depending on us to work a full day *every* day . . . to conserve gas, oil, rubber, metal . . . to buy nothing except necessities and invest the balance of our incomes in War Bonds. They're doing their job—*let's get tough with ourselves* and do our job, too!

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

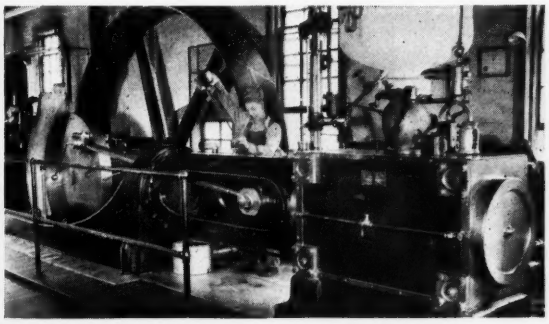
Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.



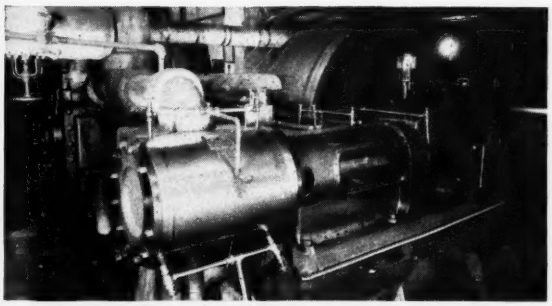
Steam engine indication is one method used by Standard Oil Engineers to bring back engine power.

During twelve years of normal operation a Corliss engine in a clay products plant gradually lost its pep—steam consumption also became excessive. The owner reports: "The engine was indicated and checked by your engineers, who recommended that several adjustments be made. We followed these suggestions and the engine is now operating like a new unit. Such engineering and technical advice has been worth real money to us. We appreciate the fact that your cooperative engineering service made this improvement possible."



Sluggish operation under load variations troubled the operator of a Corliss engine in a large Minnesota grain elevator. The engine operated cleaning equipment and conveyors, and was subjected to heavy loads as the grain traveled through the elevator.

A Lubrication Engineer analyzed the problem—poor atomization of the oil, was his conclusion. With the oil he recommended, the engine responds quickly to load changes. Incidentally, rod packing life is doubled as a result of better atomization of the new oil.



Some engines like the 20-year-old one above have been kept at peak condition by regular consultation with a Standard Lubrication Engineer. Periodic indicator service and continuous use of cylinder and engine oils recommended by the Engineer have kept repairs low and power output high. No rings were replaced in the 20 years, and no cylinder reboring has been needed at this paper mill plant.

Making yesterday's steam plants meet *today's demands*

MANY STEAM ENGINES old enough to have served in the last World War are again carrying a large share of the power load in this one. In the years between, few of these engines, or those installed later, have been called upon to produce nearly their rated loads. Maintenance and lubricating practices have been geared to an easy-going peacetime schedule. Today's needs have changed the pace. Equipment now must give unfailing service at full capacity.

Standard Lubrication Engineers have already helped many plant men bring power production up to wartime needs. A few examples are cited here.

The solutions may seem simple in telling. But years of lubrication experience are behind every recommendation—years of study and research in refining and compounding to produce cylinder oil to meet specific plant needs—years of work by these Engineers on power plant lubricating problems.

See if one of them can help you. Call any Standard Oil Company (Indiana) office or write 910 S. Michigan Ave., Chicago 5, Ill., for the Engineer nearest you. In Nebraska, call any Standard Oil Company of Nebraska office.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION E

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATI

Here are some suggestions to help keep them out of trouble

CONDITIONS under which compressors operate, particularly under today's heavy loads, tend to cause excessive deposits. Improper lubrication is not always responsible for these deposits, but a compressor lubricant with the right qualities can reduce or eliminate many of them. The causes of some of the more common compressor operating problems and suggested cures are listed here:

Unstable Oils. Oxygen in the air and heat generated by compression tend to oxidize conventional oils, causing the formation of carbon and asphaltic substances which deposit on valves.

Keep intake air temperatures as low as possible. Be sure inter-coolers and after-coolers are supplied with an ample flow of cold water to keep air temperatures as low as possible. Keep this equipment clean and free from scale and rust. Use Stanoil from which the unstable hydrocarbons—those affected by heat and oxygen—have been removed, eliminating many troublesome deposits at the source.

Dirty Intake Air. The enormous volume of air required by compressors, particularly under heavy load, may introduce a large quantity of dirt and dust.

Be sure conditions have not changed which might increase such contaminants in the intake air in your compressors. Use efficient air screens and keep them clean. Use Stanoil which resists the formation of gummy deposits that might collect dirt and dust from the air and add to deposits on valves.

Condensation in Cylinder. Cooling water temperatures are extremely important. If water supplied to the cooling jacket is excessively cold, it will cause moisture in the compressed air to condense. This will wash off the lubricant film and cause excessive cylinder wear.

Preheat jacket cooling water by running it through the inter-cooler, or reduce the flow so that the temperature of the water when it leaves the water jacket is not below 100° F.

Condensation in Inter-coolers. Water in the inter-cooler should be cold enough to condense the oil and moisture in the compressed air, so that they can be removed before they enter the high pressure cylinder and cause excessive deposits.

Be sure an ample flow of cold water is supplied to the inter-cooler. Drain condensed oil and moisture from inter-coolers and after-coolers frequently if they are not provided with automatic outlets.

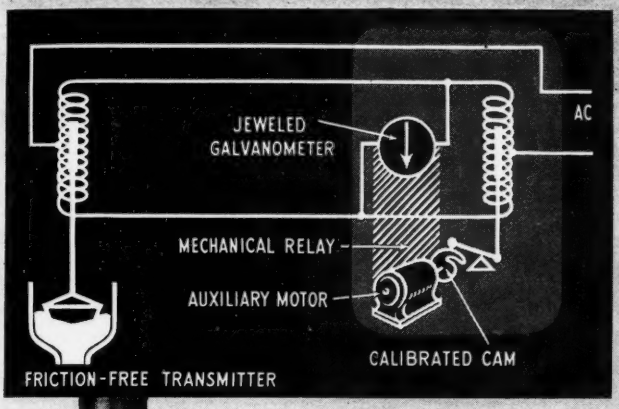
Over-Lubrication. Over-lubrication is the cause of much compressor trouble. In compressor operation, oil is not burned up as it is in internal combustion engines, nor is it washed away as it is in steam engines. Oil remains in the compressor cylinder a long time, and if it is of the right quality, very little is needed. An excessive amount of oil increases the possibility of deposits in valves, inter-coolers, and air lines.

Adjust oil feed to the minimum necessary to give an adequate film of lubricant on cylinder walls. Compressors usually require from one-fifth to one-tenth as much oil as steam cylinders of similar size. Because of the high lubricating quality of Stanoil, only a very small amount is needed to secure adequate lubrication.

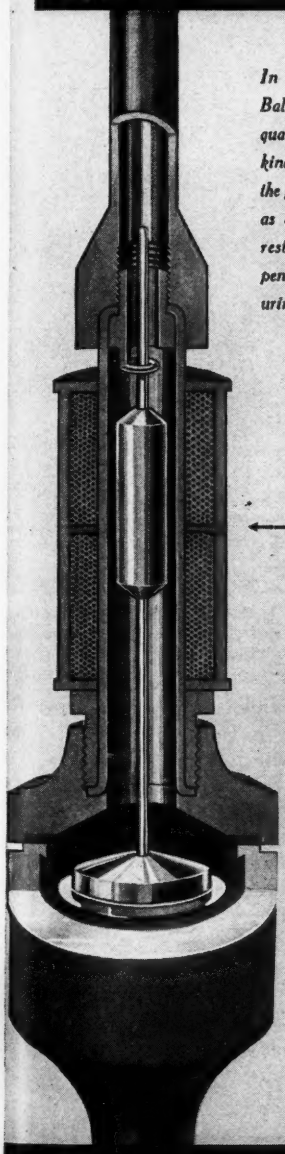
Oil is Ammunition... Use it Wisely

STANOIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE



In the Cochrane Flow Meter, the Null or Zero Balance principle is employed, balancing the unknown quantity by adjusting a known quantity of the same kind. A highly sensitive detector is used to determine the point of balance. A friction-free transmitter serves as a pilot for an external motor drive. The motor restores the bridge to balance and operates recording pen, indicating pointer, and integrator. The measuring circuit is relieved of all work.



←It Floats!

The Cochrane Friction-Free Manometer

- No Bearings
- No Stuffing Box
- No Electric Contacts
- No Solenoid "Reaction"

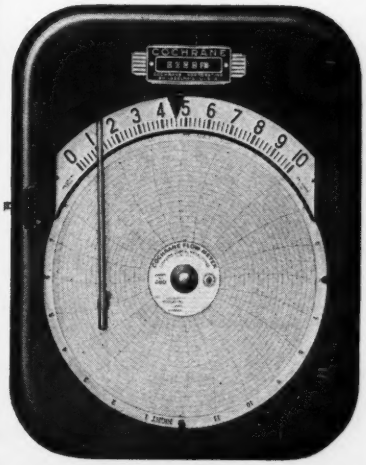
This sensitive float acts as a pilot for the auxiliary motor drive, which operates with high and equal power throughout the entire scale.

7 Range Capacities Available in Cochrane Flow Meters.

The capacity of a Cochrane Flow Meter may be altered to meet varying conditions in 15 minutes' time. Two styles of transmitter are available, one of which provides five changes of manometer tube, ranging from 18 inches water differential through 42, 75, 117 to 169. The other style transmitter provides for seven ranges, five as above plus two additional of 230 and 301 inches water differential.

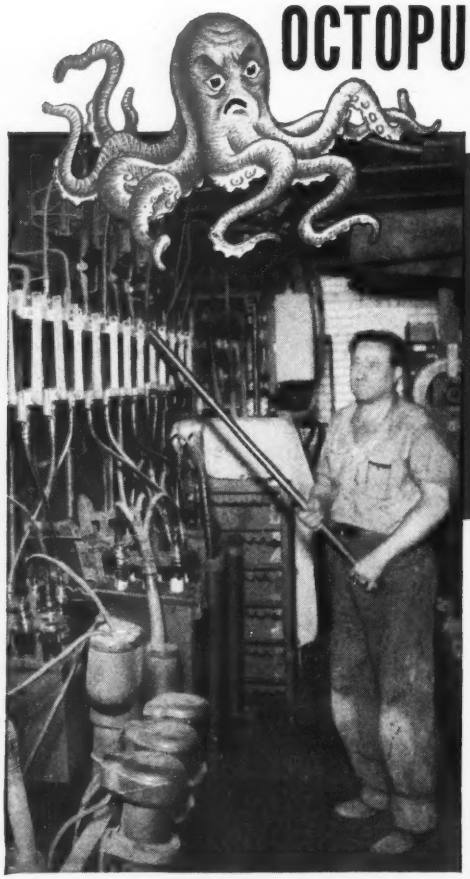
Write for Publication 3010

COCHRANE CORPORATION
3123 N. 17th St., Phila. 32, Pa.

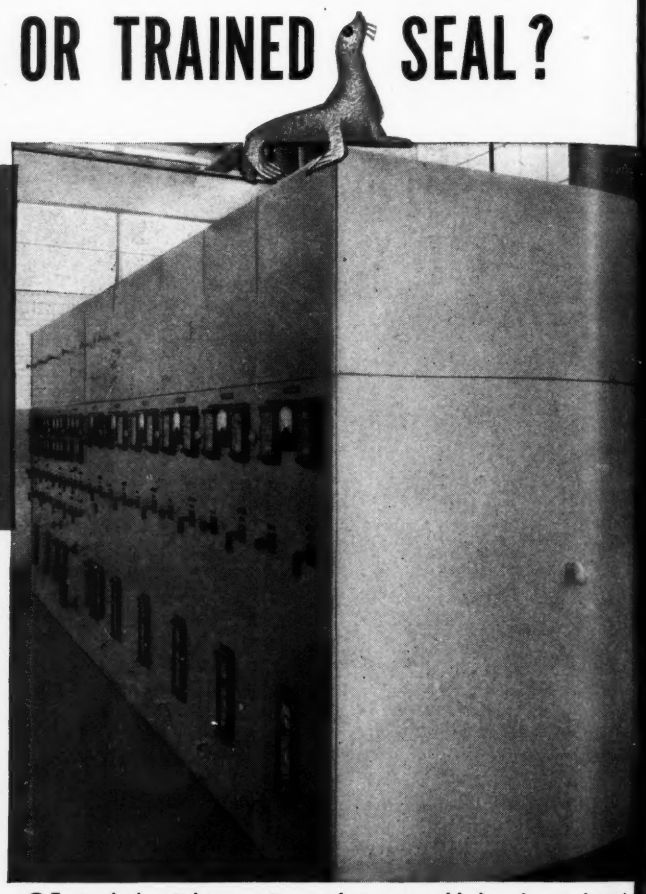


COCHRANE FLOW METERS

IS YOUR SWITCHGEAR OCTOPUS OR TRAINED SEAL?



Dangerous, "octopus" switchgear like this (above and below) originates as strung-out, open-type switchgear. Too often it is responsible for power interruptions and accidents to personnel.



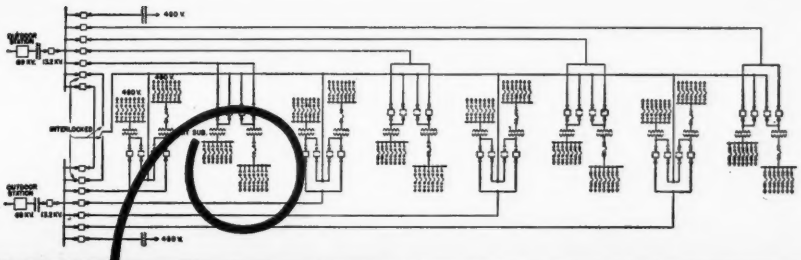
G-E standard switchgear units are factory-assembled and co-ordinated—trained to perform without a hitch. One of the many possible combinations of these standard units should fit your requirements.

PIECEMEAL switchgear installations, which grow through the years to meet increasing demands, tend to become like octopuses—unreliable, and downright dangerous. The practical provision for your present and future requirements is the standard, metal-clad unit of switchgear equipment—dependable, safe, copper-saving, space-saving, and economical both in installation cost and maintenance. The capacity of a modern, co-ordinated metal-clad system, large or small, can be increased easily and safely by adding compact units of standard, safety-enclosed switchgear.

Whether you plan expansion or replacement of your present system, investigate the advantages offered by G-E metal-clad switchgear.

The best investment in the world is in this country's future — BUY WAR BONDS

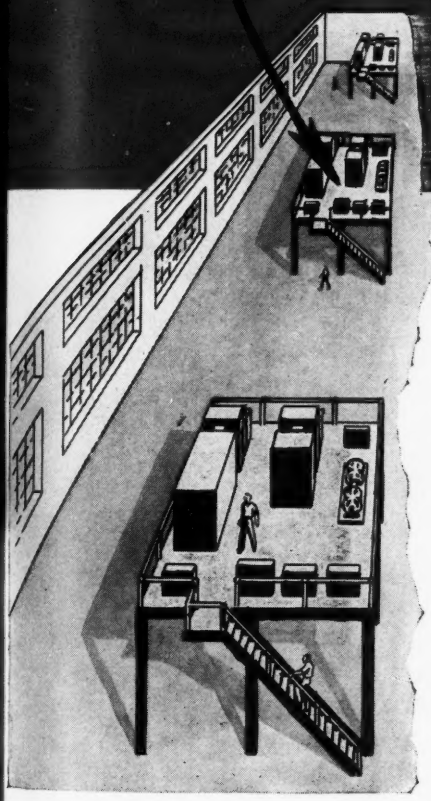
PACKAGED SWITCHGEAR



This installation affords excellent continuity and flexibility of power service, plus good utilization-voltage regulation at practically any part of the plant. Bus-tie metal-clad units interconnect the east and west groups of metal-clad switchgear; therefore, either bus can feed one or both groups of unit substations.

Here's an example of what trained performers, like G-E metal-clad, can do for you

This recent midwest industrial installation saved time, copper, and floor space



The equipment was installed on platforms, which provide space for the speedy removal of the high- or low-voltage breakers for inspection or maintenance. Equipment located here includes: 1. Unit substation for power; 2. Unit substation for lighting; 3. Converter control; 4. Induction converter; 5. Capacitor set; 6. Automatic capacitor control.

WE can't tell you now where this installation was made, but we can say that this system saved 500,000 pounds of vitally needed copper. The selection of 13,200-volt metal-clad switchgear, and corresponding cable, to supply load-center unit substations with relatively high-voltage power, made this saving possible. Also, the use of elevated platforms at the load centers, for the unit substations and other power equipment, put more than 7,000 square feet of main floor area into actual productive use.

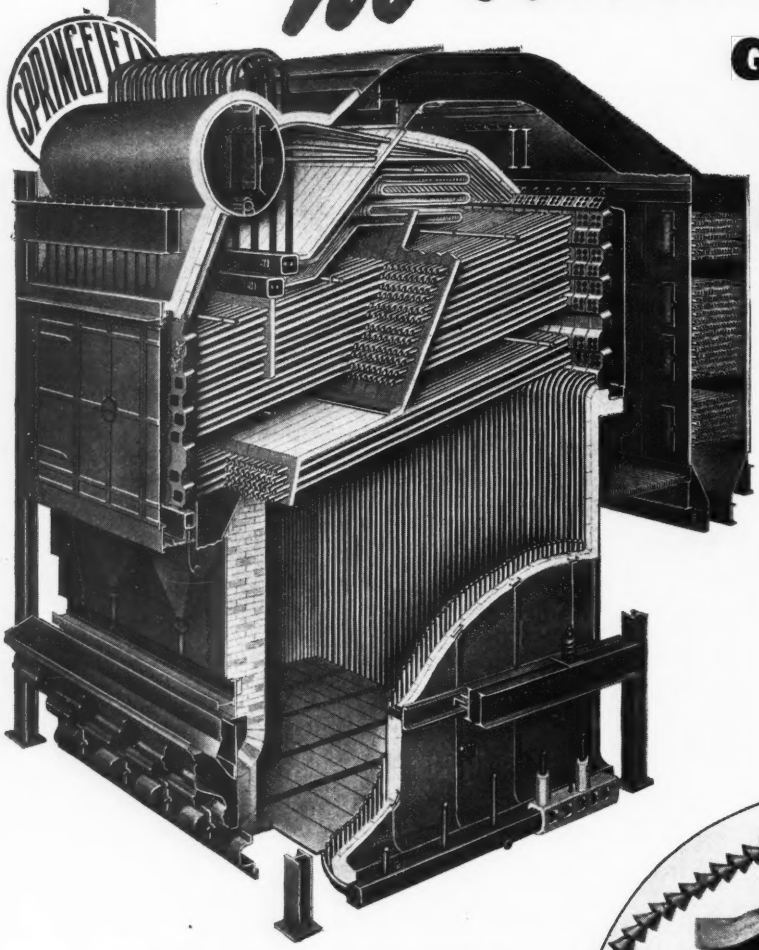
You, too, can easily effect important savings of time and material when you choose the right combination of distribution voltage and G-E standard switchgear. Factory-assembled, metal-clad packaged switchgear is installed faster, more easily, at a predictable and low over-all cost.

For your power-distribution switchgear up to 15 kv, and for safety and dependability, get the accepted standard—repetitively manufactured G-E metal-clad switchgear. *General Electric Company, Schenectady, New York.*

GENERAL ELECTRIC

no other boiler

GIVES YOU ECONOMIC

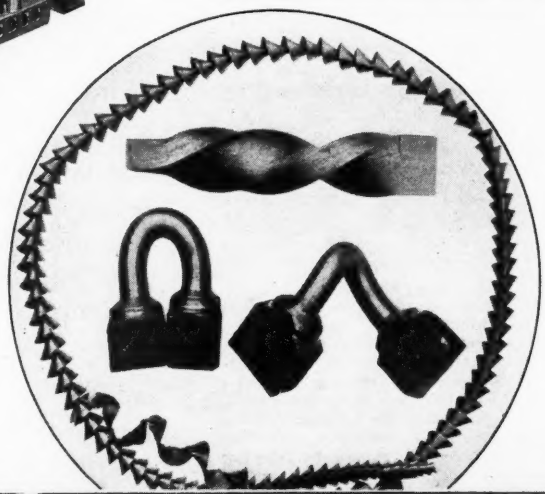


• Above — Cross-section view of typical Springfield sectional header boiler, with Springfield water walls.

• Right — Springfield header steel is produced by the electric furnace process, with analysis and physical properties complying with all construction code requirements.

SOME SPRINGFIELD BOILER USERS

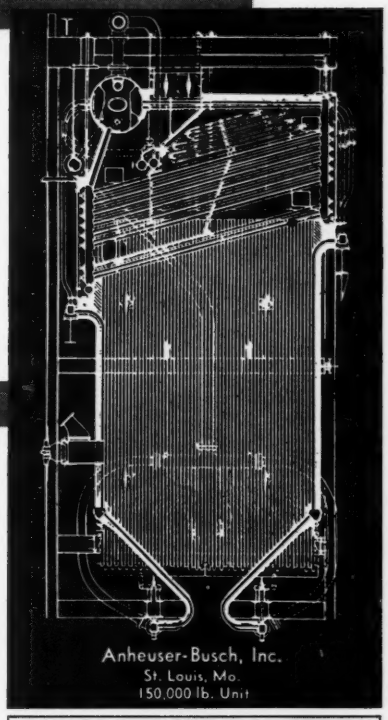
South Pittsburgh Water Co., Pittsburgh, Pa.—4 plants.
Inland Steel Co., Indiana Harbor, Ind.—6 boilers.
Anaconda Copper Min. Co., Cananea, Sonora, Mex.
State of Illinois (over 40 units in State institutions)
Hell Gate Station, United Elec. Lt. & Power, N. Y. C.
East River Station, New York Edison Co., N. Y. C.
Sherman Creek Station, New York Edison Co., N. Y. C.
Iowa Elec. Lt. & Pow. Co., Cedar Rapids & Boone, Ia.
Princeton University
Carnegie Institute of Technology
University of Illinois
University of Wisconsin
Deere and Company
Northern States Power Co., Minneapolis, Minn.
Anheuser-Busch Co., St. Louis, Mo.
Owens-Illinois Glass Co., Alton, Ill.
hundreds of others, in the U. S. and abroad.



SPRINGFIELD

MODERN STEAM GENERATING UNITS

design...
ALL THESE ADVANTAGES



Anheuser-Busch, Inc.
St. Louis, Mo.
150,000 lb. Unit

IN WAR TIME, as in peace, the advantages inherent in the Springfield cross drum, sectional header boiler design make possible economic savings that have solved the power problems for important industrial and utility plants throughout the country. You SAVE

—in fuel cost, by higher efficiency as proved by lower exit gas temperatures, through smaller tubes, staggered tube grouping, permanently tight baffle construction, and a carefully engineered overall design.

—in maintenance cost; larger and fewer handhold openings reduce the time and cost of cleaning, inspection and repairs. The straight tubes are easy to clean and renew. Standardized tubes reduce inventory of spares. No staybolts. Soot and ash cannot lodge on headers and drums. Protected cross tube baffles. Sturdy electric steel headers.

—in erection cost, and time; because of factory-assembled sections, from 30 to 60 days are saved on erection time. Less brickwork is required. Cross-tube baffles delivered in place. More of the fabrication is performed by experienced shop mechanics.

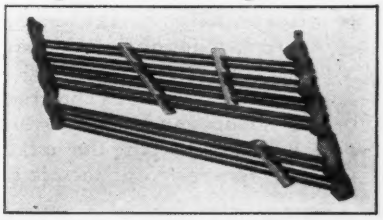
—in engineering. Complete drawings, patterns, etc., are available to produce duplicate units of many of the great number of modern Springfield generating units built in recent years.

—in steaming time, assured by small size tubes arranged for more efficient heat absorption. Dry steam is provided by cross drum arrangement, large drum size, steam delivery above water level, and efficient internal drum baffling.

—in space. Springfield boilers are lighter and more compact than other designs, and are readily adapted to restricted space requirements. High capacity in comparatively small space.

The Springfield boiler design is flexible enough to be economically adapted to a wide range of fuels, load, space, water, or other condition. Capacities from 5,000 to 450,000 lbs. per hour, or more. Pressures from 75 to 750 psi, or higher. Contracts taken for complete steam generating units. Write for information. SPRINGFIELD BOILER COMPANY, 1951 E. Capitol Ave., Springfield, Ill.

• Sectional header design makes possible shop assembly of even the largest units.



BOILER CO.

ANY SIZE • ANY FUEL • ANY PRESSURE

HERE'S ONE ROD PACKING THAT WON'T WEAR OUT IN A HURRY...
JM
• With virtually the entire production of J-M Packings and Gaskets needed for war, delivery on other than high-priority orders may be slower than in normal times. However, through increased capacity and round-the-clock production, every step is being taken to assure the fastest delivery possible under the present emergency.

J-M KEARSARGE LASTS LONGER . . . CUTS RE-PACKING COSTS

For continued efficient service against high-pressure steam, you can't beat this rugged rod and plunger packing.

Its unique folded construction provides natural resiliency and forms a reservoir for the preserving lubricant, keeping the packing pliable in service.

Additional resiliency is provided by a rubber expansion back in the center block. And resistance to wear is assured by a double wrapping of asbestos cloth.

You can use Kearsarge Rod Packing, together with other packings and gaskets in the complete Johns-Manville line, to minimize equipment shutdowns . . . save much of the expense and loss of production caused by too-frequent re-packing.

For details, ask for the J-M Packing Catalog, Johns-Manville, 22 East 40th Street, New York 16, New York.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

But boiler tubes are too vital to burn up needlessly

. . . and it is not necessary to tie up your boilers, due to premature tube failures caused by scale formation. Avoid shutdowns, worry, extra overtime work, and expense caused by boiler scale. Of course, when tubes are rendered useless, see that they get into the scrap quickly, and keep the scrap moving to hungry open hearths to be converted into war materials.

Dearborn Treatment and Engineering Service is designed to fit the special operating conditions of your individual plant. It is balanced to provide full protection against scale and corrosion and to reduce the possibility of steam contamination. Dearborn Engineer is nearby to help you. Call or write. Dearborn Chemical Company, Dept. F, 310 S. Michigan Ave., Chicago 4, Illinois.

[Keep the scrap moving . . . and buy still more War Bonds and Stamps]

Dearborn
TRADE MARK REGISTERED
BOILER WATER TREATMENT AND SERVICE

Accurate under most severe operating conditions

Whether you measure steam, compressed air, water or high pressure gas flows, the exclusive, simplified, "free floating" meter mechanism of ADSCO Flow Meters (orifice type) provides sustained operating accuracy over an exceptionally wide range of flow.

Records and totalizes on direct reading, evenly divided charts. Changing chart and inking pen can be performed quickly by an unskilled attendant without the least chance of damaging the mechanism or disturbing any adjustments.

Available in four types with standard or high velocity body as follows: Recording—Recording and Integrating—Indicating and Recording—Indicating, Recording and Integrating — with or without auxiliary pressure recorder to record working pressure on same chart as flow.

Write us regarding your meter problems, also ask for bulletin 35-83E.

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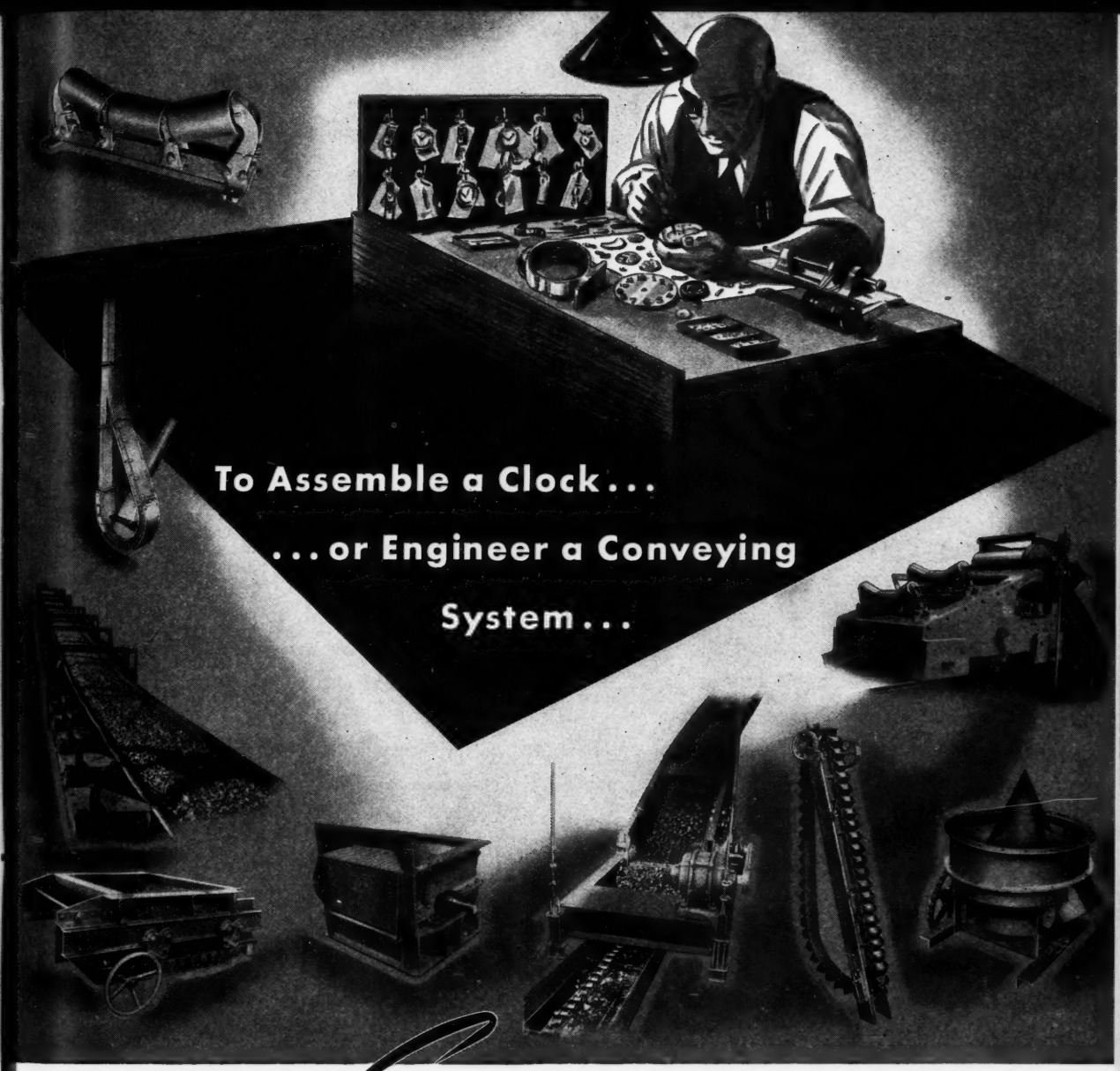
MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

ADSCO FLOW METER



It Takes *Experience* To Make Them Tick!

Whether it's putting together the numerous intricate parts of a clock . . . or assembling the many different, complex kinds of conveying equipment that makes up an efficient material handling system . . . experience is indispensable. This is a qualification you will find in abundance at Stephens-Adamson, a leading designer and manufacturer of handling equipment for over 41 years.

That's why it will be decidedly worth your while to discuss present or post-war conveying methods with an S-A engineer. Make a date now for such a discussion—either as a step toward putting present handling operations on a more efficient basis, or getting a head start toward the solution of new problems connected with peace-time production.

STEPHENS-ADAMSON MFG. CO., 515 Ridgeway Avenue, Aurora, Illinois

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Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT

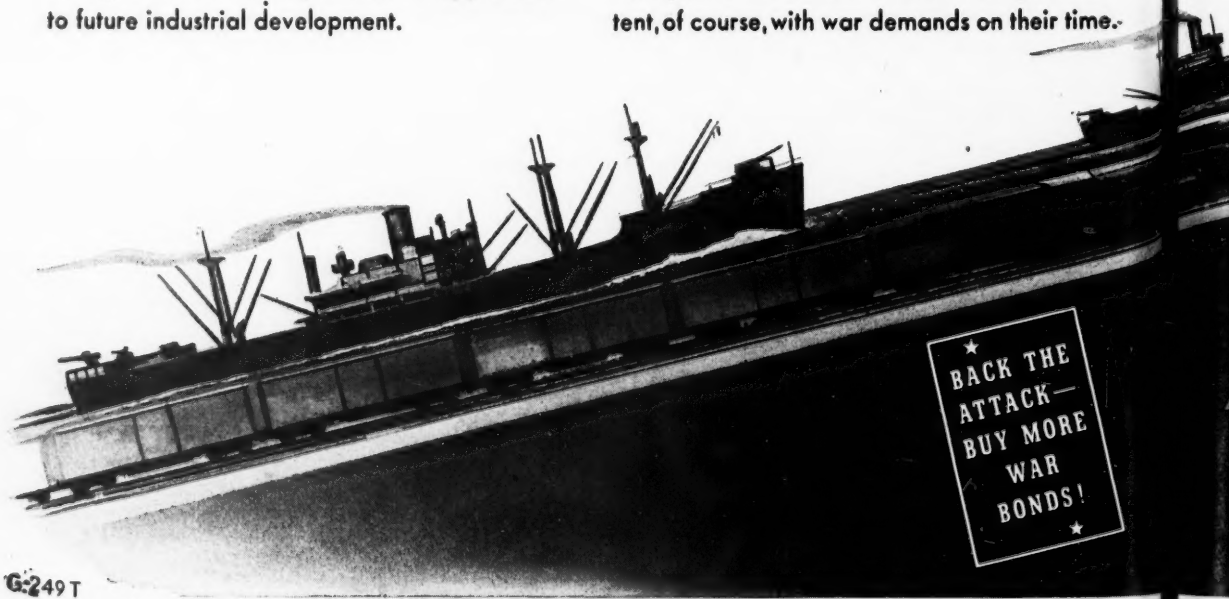
Rebuilding a World ***for STEAM***

The tough tasks of steam plant rehabilitation and development, will fall on engineers who are now serving their country in the armed forces, or in the never-ending battle with power-plant problems in war plants and in public utility plants supplying power to war plants. In this they are applying their engineering knowledge and skills to the early conclusion of hostilities.

When the war will have ended and Victory is ours, these engineers will re-direct their knowledge and skills from war-making activities to the production of steam power for peaceful pursuits, utilizing whatever of their background of war experience is applicable to future industrial development.

We of Babcock & Wilcox have implicit confidence in their resourcefulness, confidence in their ability to continue overcoming almost impossible assignments. Serving other engineers has also kept us on our mettle, as evidenced by important B&W contributions to the continued evolution of practice in steam generation.

While the war effort has first call on your industry's time and resources, you undoubtedly have given some thought to the postwar power-plant problems that will confront you, as it is never too early for engineering planning. B&W engineers will gladly cooperate with you to the utmost of their ability, consistent, of course, with war demands on their time.



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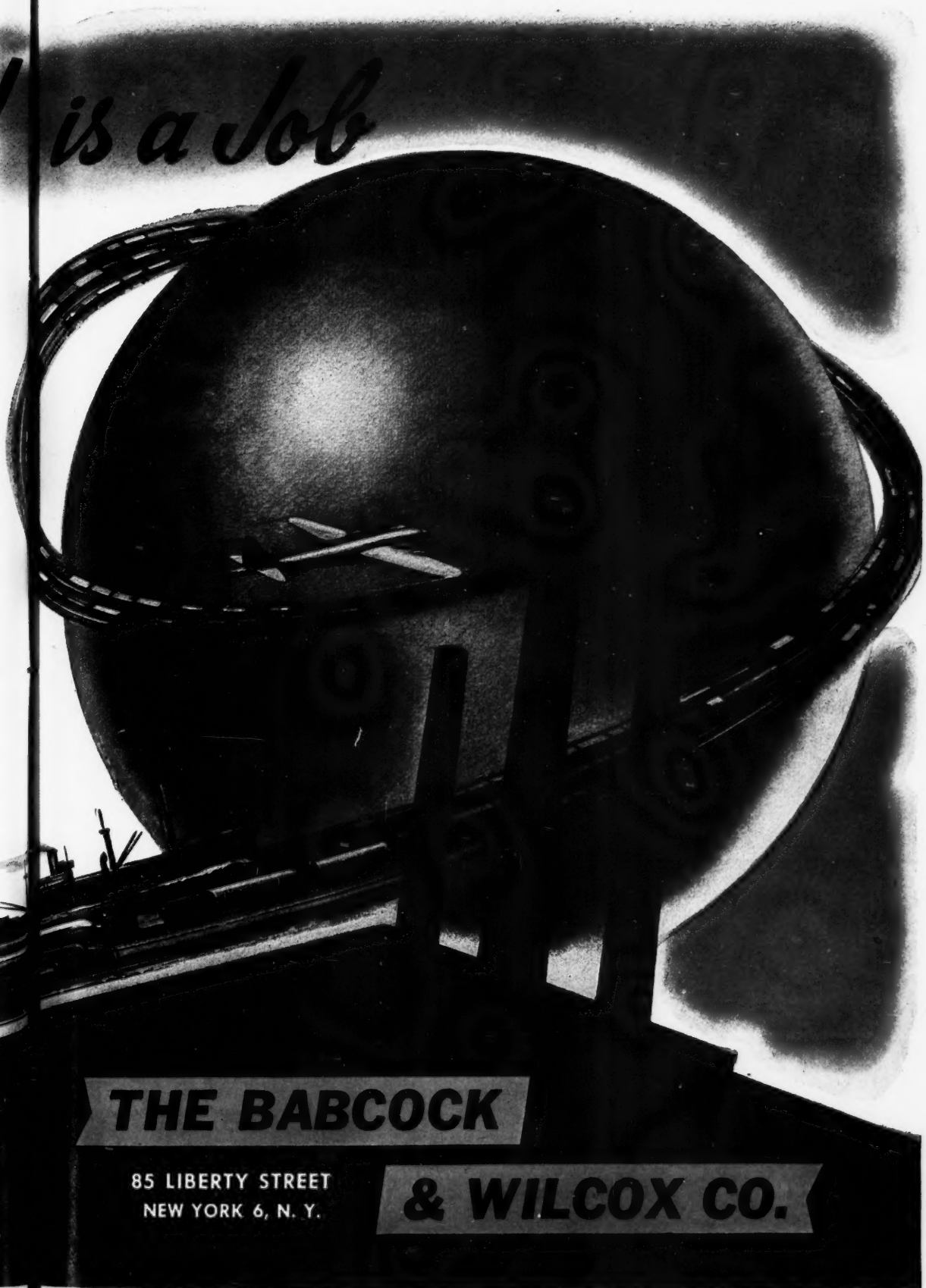
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THE BABCOCK
85 LIBERTY STREET
NEW YORK 6, N. Y.
& WILCOX CO.

Look out for CONCENTRATION-CELL CORROSION

...the corrosion that hides!

Often better known as "deposit attack" or "crevice corrosion," this action usually attacks hidden and secluded areas of metal. It destroys metal more rapidly than ordinary corrosion.

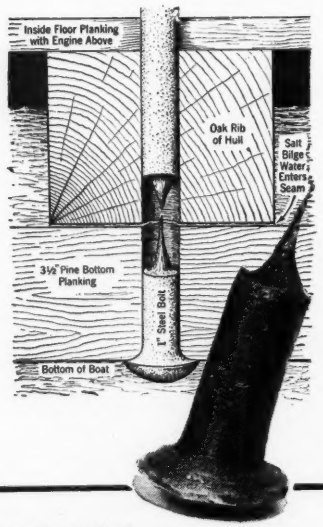
That concentration-cell corrosion "hides away" and is also fairly common may be judged by noting some of the conditions that favor it and where such attacks are likely to occur . . . cracks and crevices in welded seams; unsealed crevices of all types of lap joints; fissures in metal caused by forming operations; *under* and *around* various accumulations on metal surfaces . . . marine growths . . . silt, scum, and salt encrustations and deposits . . . scale in evaporator and condenser tubes; brine, acid or other chemical-solution soaked timbers around tie-rods, staybolts and similar metal members.

Other factors, such as wet packings in idle machinery, stagnant areas in tanks and pipes and many more conditions, far too numerous to list, also favor the action. Preventive measures usually become obvious when each case is examined from the standpoint of the principles of concentration-cell effect.

Our illustrated folder, "How to Recognize and Control Concentration-Cell Corrosion," tells how, why and where this corrosion action attacks so that practical control measures can be devised for practically any situation.

INCO's Technical Service, on request, is prepared to assist engineers further in solving or avoiding concentration-cell corrosion problems. As a first step in securing INCO's help in a specific case, write for a copy of the Corrosion Data Work Sheet.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.


Inside Floor Planking with Engine Above
Oak Rib of Hull
Salt Bilge Water Enters Seam
3½" Pine Bottom Planking
1" Steel Bolt
Bottom of Boat

Actual Example of Concentration-Cell Corrosion

The 1" steel bolt holding down the engine bed of a New York Harbor motor lighter looked like this sample after being in service only two years. See Note 9 below.

PRACTICES for PREVENTING CONCENTRATION-CELL CORROSION

1. In new equipment specify butt joints and emphasize the necessity for complete penetration of the weld metal to guard against even minute crevices.

2. Lap joints should be avoided wherever possible or thoroughly sealed with weld metal or solder. In place of metal, a suitable caulking compound may be used if crevices and voids under the compound can be avoided during application or can be quickly corrected if they appear during service.

3. Existing lap or spot welded joints, that show evidence of crevice corrosion, should be cleaned as well as possible and all channels for liquid penetration —rivet heads, overlaps, and all crevice-like areas—sealed with weld metal, solder or caulked.

4. In design of vessels avoid sharp corners, stagnant areas or other sites favorable to the accumulation of precipitates and other solids.

5. Institute a routine of frequent, thorough cleaning of all metal areas subject to accumulations of deposits, scale or "skins." In marine work this precaution applies to marine growths, silt, scum and salt encrustations and deposits.

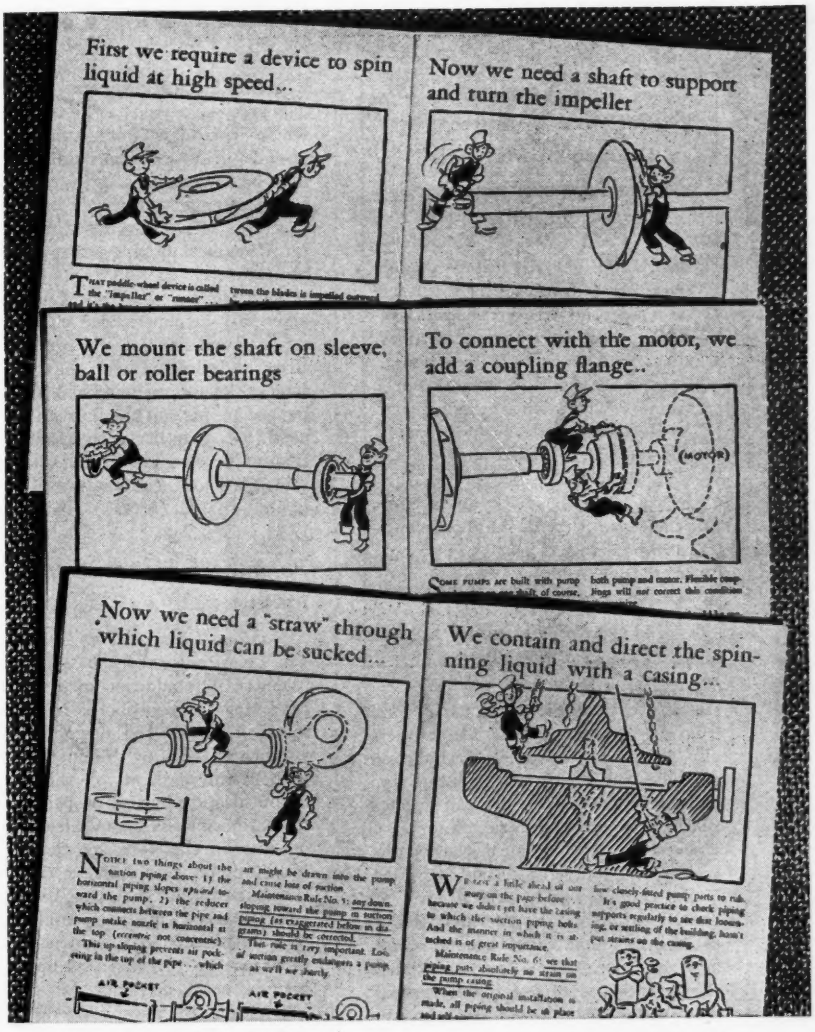
6. In the design and operation of tubular heat exchangers, endeavor to provide for uniform flow of liquid with a minimum of turbulence and air entrainment.

7. Provide suitable strainers in heat exchanger cooling medium lines to prevent local obstructions within the tubes which may start deposit attacks, or result in turbulence and impingement.

8. Remove all wet packing materials (unless of the corrosion-inhibiting type) from any equipment scheduled for a long shut-down period since concentration conditions under packings may become similar to those under deposits.

9. Because soaked timbers in contact with metal surfaces — tie-rods, pipes, stay-bolts, and similar members — promote concentration-cell effects, keep tie-rods tight and promptly repair all leaks in wooden tanks, even those that might otherwise be considered trifling. When soaking of timbers cannot be prevented, fastenings of highly corrosion-resisting metals offer the best protection. Fastenings of less resistant metals may be somewhat protected by coating with a suitable paint before installation.

Let's Build a Pump!


First we require a device to spin liquid at high speed...
Now we need a shaft to support and turn the impeller
We mount the shaft on sleeve, ball or roller bearings
To connect with the motor, we add a coupling flange..
(MOTOR)
Now we need a "straw" through which liquid can be sucked...
We contain and direct the spinning liquid with a casing...
AIR POCKET
AIR POCKET

When you do need new pumps — look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps... the famous "Electrifugal"... and all types for every purpose.

ALLIS-CHALMERS
MILWAUKEE

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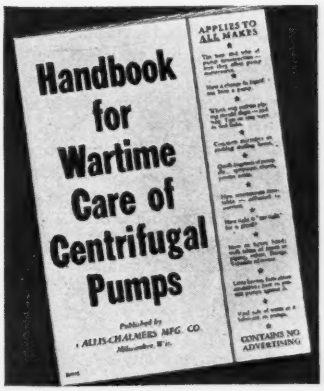
WITH MOST PUMPS today doing *3 and 4 times* their normal work, they need the finer kind of care set forth in Allis-Chalmers' new "Handbook for Wartime Care of Centrifugal Pumps". Every executive, engineer and maintenance man should have a copy of this informative book in his technical library!



This book applies to *all* makes of pumps — contains no advertising! Contents include: new preventive maintenance tips; *war* timetable for pump care; valuable tables, etc. Tear out coupon and send in now for your *free* copy!

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Milwaukee 1, Wisconsin

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Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 6

Choosing the Right Alloy for Long-Lived Condenser and Heat Exchanger Tubes

Selection of Material

The selection of the alloy for any particular service, will depend upon the conditions under which it must operate. The many factors which must be considered in this connection have already been discussed. It is evident that each application of tubes in a condenser or heat exchanger is an individual problem which must be studied in detail before any specific recommendation can be made regarding the most economical and satisfactory tube material for use in the particular case. An investigation of this kind would cover not only a survey of all the known service conditions but would also take into consideration the alloy previously used and the type or form of corrosion previously experienced in the unit in question or in similar units operating under similar conditions. It is obvious that the subject can only be treated in a very general way without a consideration of all the essential facts which might apply to an individual case. The following information, therefore, is designed principally to give some indication of the conditions under which available condenser tube materials have given satisfactory service. In most cases it will be noted that two or more alloys may be used under a certain set of service conditions; in certain services, it is true that a rather wide choice of tube materials may be made without any appreciable difference in operating costs or service life. In other cases, where corrosion of some form is particularly severe, selection may be limited to one or possibly two of the more refractory materials.

Muntz Metal:

Nominal Composition, Copper 60%; Zinc 40%. Muntz metal tubes have been used extensively in both fresh and salt water service in steam condensers operating at relatively low temperatures. Use at the present time is confined chiefly to steam condensers at inland stations with fresh circulating water from rivers, lakes or wells. Muntz metal also has good resistance to hydrogen sulphide and other active sulphur compounds but is seldom used in applications where corrosion by such compounds is severe primarily because other factors, such as high temperature, high velocities, badly contaminated waters, etc., are usually active at the same time. Failure of Muntz metal tubes occurs usually as a result of gradual dezincification of the layer type. Muntz metal tubes in fresh water steam power plant installations have had a service life of twenty years or more.

Scovill's Analytical "Service In Manuals" Helps Many Firms Save Scarce Tube Metals

Both before and after installation of condenser or heat exchanger tubes, success depends on expert knowledge of the exact interrelation of tube alloys with the service conditions. This article is part of Scovill's continuing "Tube News" series; all preceding issues, dealing with tube manufacture, causes of corrosion, etc., are available on request, together with Scovill's up-to-date "Condenser Tube Booklet" covering the broad range of problems bearing on tube life. Address, Scovill Manufacturing Company, 17 Mill Street, Waterbury, Conn.

Admiralty Metal:

Nominal Composition, Copper 70%; Zinc 29%; Tin 1%. This alloy has excellent corrosion-resistant properties and is used widely in tube form in such diverse services as: steam condensers using fresh, salt, brackish or acid mine water for circulating purposes; heat exchangers, coolers, etc., in oil refineries where corrosion from sulphur compounds, acids and contaminated waters may be very severe; feed water heaters, heat exchanger equipment in industrial processes, etc. Admiralty metal tubes are often used in apparatus operating at temperatures of 400°F. or higher although severe dezincification of the alloy may be experienced under certain service conditions at elevated temperatures. Admiralty metal has a tensile strength of approximately 50,000 pounds per square inch in the finished annealed condition, together with excellent ductility. The strength of the alloy is retained up to a temperature of approximately 300°C. (570°F.).

Phosphorized Admiralty Metal:

Nominal Composition, Copper 70%; Tin 1%; Phosphorous 0.03%; Zinc remainder. The addition of a very small percentage of phosphorus to admiralty metal increases the dezincification-resistance of the alloy to a marked degree without impairment of the excellent chemical and physical properties of the alloy. Phosphorized admiralty metal was developed, therefore, particularly for installations where severe dezincification of admiralty metal has been experienced or is anticipated. Combining as it does resistance to dezincification and resistance to corrosion by sulphur compounds, acids, contaminated fresh and salt waters, etc., phosphorized admiralty metal has found wide usage.

Red Brass:

Nominal Composition, Copper 85%; Zinc 15%. Red brass is sufficiently high in copper content so that it does not dezincify under normal service conditions; it is also not as susceptible to season cracking or stress-corrosion cracking as brasses of lower copper content

and combines favorable physical and chemical properties to make it a very serviceable alloy for many heat exchanger installations. Red brass tubes have been used chiefly for service in contact with fresh waters although tubes of this alloy have also served very satisfactorily in uncontaminated salt water. This alloy is not generally recommended for use where corrosion by Hydrogen Sulphide or other active sulphur compounds is liable to be severe.

Deoxidized Copper:

Tubes of deoxidized copper (copper content 99.90%) are limited to applications where the high purity of the material is essential or where it is necessary to utilize the high thermal and electrical conductivity of pure copper. It has excellent resistance to practically all types of fresh water and to many chemicals. It is not usually serviceable in contact with salt water or active sulphur compounds. In the hard-drawn temper copper has a strength of approximately 60,000 pounds per square inch but it does not retain this strength at temperatures of 200°C. or higher.

Arsenical Coppers:

Nominal Composition, Arsenic 0.35%; Copper balance. The alloying of a small percentage (0.15–0.50) of arsenic with copper reduces the electrical and thermal conductivity of the copper 25% to 50%. Compared with deoxidized copper, arsenical copper has (1) a higher softening or annealing temperature (300°C. against 200°C.), (2) increased strength, hardness and stiffness of cold drawn material with no impairment of ductility, a higher fatigue limit, etc. Arsenical copper has been reported to be slightly more resistant to atmospheric corrosion than copper and equally as corrosion-resistant as copper in salt or fresh waters. Arsenical copper tubes find their principal usage in condensers and heat exchangers using fresh circulating water; they are not usually recommended for service in contact with hydrogen sulphide or other active sulphur compounds, with media carrying an appreciable percentage of organic acids, particularly in the presence of air (oxygen) or with acid solutions of an oxidizing character, such as acid mine waters. Their chief advantages over deoxidized Copper for heat exchanger service are (1) greater strength, (2) better resistance to erosion and abrasion, and (3) higher softening temperature.

Aluminum Brass:

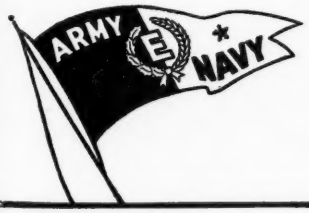
Nominal Composition, Copper 76%; Aluminum 2%; Zinc 22%. The addition of approximately 2.00% of Aluminum to Brass of the above copper content, improves the resistance of the resulting alloy very materially, particularly to corrosion by salt and brackish waters and to combined erosion and corrosion in salt water service. The excellent corrosion resistance of this depends upon the nature of the film which develops over the surface of the tube. In service, this surface film is of the desired properties (thin, adherent, continuous, compact) to give excellent protection to the metal even under very severe water conditions; in addition the film is self-healing in case of a local breakdown, such as might occur through abrasion or erosion of the metal surface, making tubes of this alloy very serviceable in installations where tubes of other alloys might suffer rapid localized corrosion. Aluminum Brass tubes have been used quite extensively during the past ten years in marine condensers and in steam condensers of tidewater stations where relatively high velocities of the circulating water, together with turbulence and air bubble impingement, have a particularly severe local wearing action on Admiralty metal and other brass tubes.

70-30 Copper-Nickel:

Nominal Composition, Copper 70%; Nickel 30%. Tubes of this alloy are used in heat exchanger equipment under conditions where severe wear and corrosion have been experienced, particularly at elevated temperatures and at high velocity of the circulating media. Copper-Nickel tubes have given excellent service, for example, in ship condensers of the U. S. and British Navies, in steam condensers of tidewater stations where brackish or salt circulating waters are very corrosive, in various oil refining units operating at relatively high temperatures and in contact with corrosive materials, etc. 70–30 Copper-Nickel combines excellent corrosion-resistant properties with very favorable physical characteristics, such as high strength and extreme ductility. The strength of the alloy is retained even at relatively high temperatures. The thermal conductivity of this alloy is approximately one third that of Admiralty metal; actually, however, the heat transfer coefficient of a new unit is reduced only slightly when Copper-Nickel tubes are used in place of Admiralty metal. Some designers of heat transfer equipment allow 5% more tube surface area when Copper-Nickel replaces Admiralty or other brass tubes. Copper-Nickel tubes are not subject to season cracking or stress corrosion cracking so they may be used with safety either in the finished annealed or hard drawn condition. The preference at this time is for finished annealed tubes.

80-20 Copper-Nickel:

Nominal Composition, Copper 80%; Nickel 20%. The Copper-Nickel alloy containing 20% nickel has similar physical and chemical properties to the 70-30 Copper-Nickel and is, therefore, used in the same type of service, i.e., in marine and tidewater steam condensers, in oil refining installation, etc. The corrosion-resistant properties of the alloy are not equal to those of the higher nickel alloy so that the 70-30 alloy is still generally used under extremely severe conditions. In many cases, however, conditions may not be severe enough to justify the use of 70-30 Copper-Nickel and in such cases, 80-20 Copper-Nickel may give economical and satisfactory service.



THIS IS NUMBER SIX in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

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Service in Manuals... Service in Metals... Service in Men

IN 194...? M-H/Brown Electronic Recording and Control Instruments will usher in a new era in peacetime production.

In the manufacture of chemicals, petroleum products, steels, textiles, rubber, ceramics, paper, foods—and other products, M-H/Brown Electronic Instruments will provide a new conception of greater precision in measuring and controlling industrial processes.

We are proud of the M-H/Brown background of over 100 years' experience in instrument engineering which *pioneered electronic instrumentation.* Today these instruments are producing the tools of war. When peace comes they will be available to industry. *M-H/Brown Electrons are coming.*

The Brown Instrument Company, 4491 Wayne Avenue, Philadelphia, Pennsylvania, a division of Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England — Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by*

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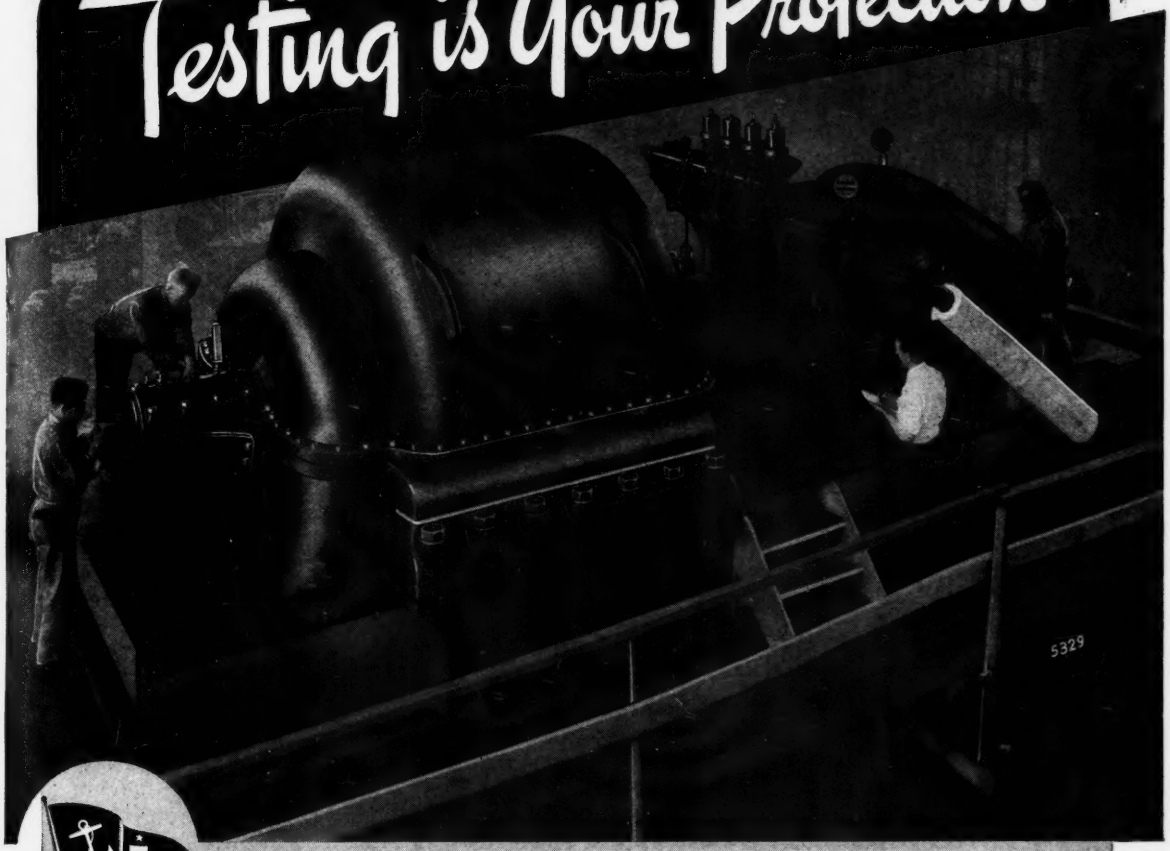
Testing is Your Protection



90,000 cu. ft. per min. turbine-driven blast furnace blower on test in De Laval Works

The De Laval Testing Division, which is operated as a separate department by competent men who devote their entire time to testing, is of benefit to purchasers of De Laval equipment in two ways:

1. Testing gives assurance that the apparatus meets guarantees as to efficiency, head or pressure, volume or capacity, etc., and that its mechanical operation is satisfactory.

2. The results of tests on each machine enable the De Laval designing engineers to improve and perfect the product.

Where apparatus must be built for a great variety of operating conditions, as in the case of steam turbines, centrifugal pumps and compressors and rotary pumps, a consistent policy of testing is particularly important.

M-26

DE LAVAL *Steam Turbine Co.* **TRENTON 2, N.J.**

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC; PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL; and FLEXIBLE COUPLINGS.

Easy spreading
Now SEAL both OIL and WATER
NEW JOHN CRANE
PLASTIC LEAD SEAL
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Temperatures to 600° F. . . . Pressures to 4000 pounds per sq. in.
SERVICES: Oil, gasoline, kerosene, benzol, propane, butane, bottled gases, steam, water, hydrocarbons, aqueous solutions, ammonia, CO_2, toxic and inflammable gases, lutings in plugs.
EQUIPMENT: Threaded joints, flanges and gaskets, nuts, caps, valves, plug valve stems and seats, safety fuse plugs, screwed fittings, pumps, cylinder heads, boilers, compressors, stills, tanks, towers, gas stoves, etc., etc.
One "easy-spread" application and your sealing job is done—for sure, for years! John Crane new lead-seal is plastic: will not set or seize nor harden under temperature extremes. Joints may be broken after years of service and remade without scraping. Protects threads, eliminates corrosion. Prevents scoring and galling. Adjusts to all clearances. May be applied to cork, paper, asbestos, copper, aluminum, lead, steel . . . John Crane Insoluble Plastic Lead Seal is a scientific laboratory formula made from pulverized metallic lead carried in a special vehicle: smooth, easy-spreading, fast-flowing. It is chemically pure: no red lead, clay filler or dope. An insoluble lubricant as well as a seal . . . Send for prices, sample and literature. Packed in 1, 3 and 5 pounds ready for use.
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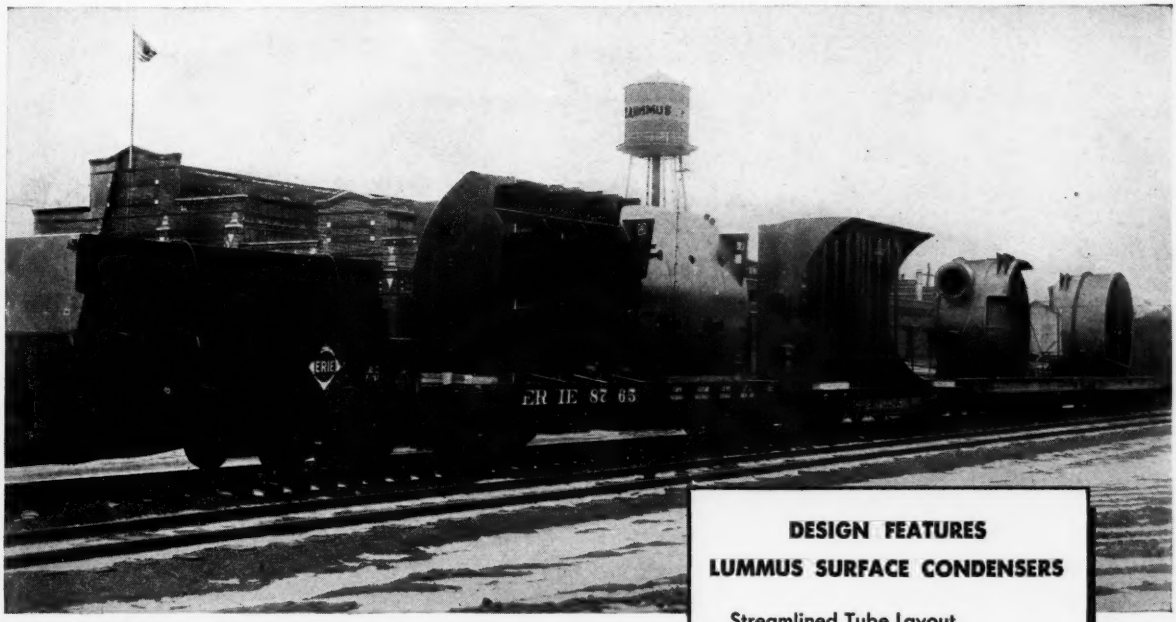
JOHN CRANE
PLASTIC LEAD SEAL
Extensively used by
LEADING AIRPLANE BUILDERS

ONE of FOUR

Surface Condensers
Totaling 122,000 Square Feet



Typical of larger surface condensers designed and built by Lummus is this 36,000 square foot unit for a well-known public utility. Precision workmanship in the Lummus Company plant will facilitate easy and accurate assembly in the field.

All Lummus condensers are equipped with air-ejectors designed and built by Lummus.

DESIGN FEATURES
LUMMUS SURFACE CONDENSERS

- Streamlined Tube Layout
- Internal Air Cooling Section
- Deaerating Hotwell

RESULTING IN —

- Minimum Pressure Drop
- Minimum Condensate Depression
- Minimum Condensate Oxygen Content
- Minimum Air Ejector Steam Requirements

THE LUMMUS COMPANY • 420 LEXINGTON AVE., NEW YORK, N.Y.

LUMMUS

"SHORT-COUPLED--LIKE A POLO PONY"

said an engineer about the new Elliott 1300 Series tube cleaner. A good polo pony can "turn on a ten-cent piece" as the saying is — and this new cleaner with its hinge coupling can do almost that.

MORE POWER IN A SHORTER COUPLED MOTOR because of new design factors and the new Elliott lubrication system. Elliott tube cleaner engineers have succeeded in designing a combination, which will get around close radius tube turns, and at the same time deliver a greater flow of smooth power streamlined to the cutter heads.

THE NEW HINGE COUPLING — ANOTHER ELLIOTT ACHIEVEMENT easily and automatically adjusts the connection of hose and motor to any angle within a wide range, required by the tube turn. The hinge coupling is airtight in any position, strong, permanently assembled. It is a new and distinct addition to the ease of tube cleaning operation.

Get all the details on these and other advances in tube cleaning equipment. Write.

THE *New*
ELLIOTT
1300 Series
TUBE CLEANER

ELLIOTT COMPANY
Tube Cleaner Department
SPRINGFIELD, OHIO
DISTRICT OFFICES IN PRINCIPAL CITIES

Y-201

FULL CAPACITY WITHOUT WASTE OR OUTAGE

Bailey Boiler Control Insures Safe Economical Operation At High Rates of Steaming

★ Full capacity is obtained from a steam generating unit only when the many factors which enter into its operation and control are carefully coordinated and accurately maintained at their optimum values.

Care must be taken in approaching these optimum values since serious waste and danger of breakdown is likely to occur unless dependable measurements of the factors are made and continuous vigilance is exercised in their control.

Blind efforts to increase boiler capacities by raising combustion efficiency may result in waste of fuel and in serious damage to boiler furnaces.

High capacities may be safely and economically attained with the help of Bailey Boiler Control which continuously maintains the following factors at their optimum values:

1. Steam pressure; to provide maximum turbine efficiency and to prevent waste through safety valves.
2. Steam temperature; to provide maximum turbine efficiency and to prevent damage resulting from excessive temperatures.
3. Fuel—Air Ratio; to keep to a minimum the volume of gases which must be moved through the boiler per unit of heat release, and to reduce excess air loss to a minimum without decreasing fuel economy or damaging furnace refractories.
4. Feed water flow and level; to maintain a uniform heat demand and to avoid both "high" and "low" drum level.

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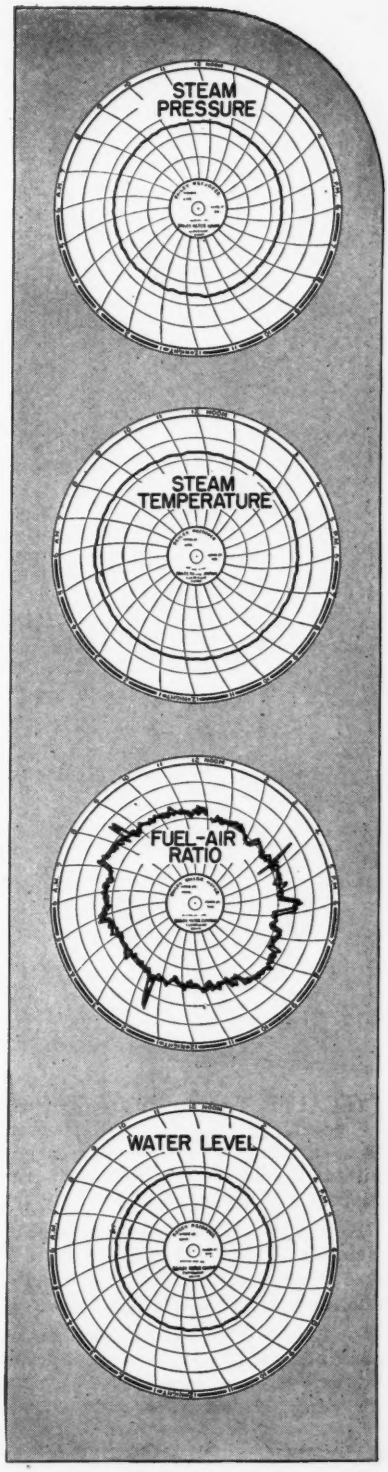
A-88-1



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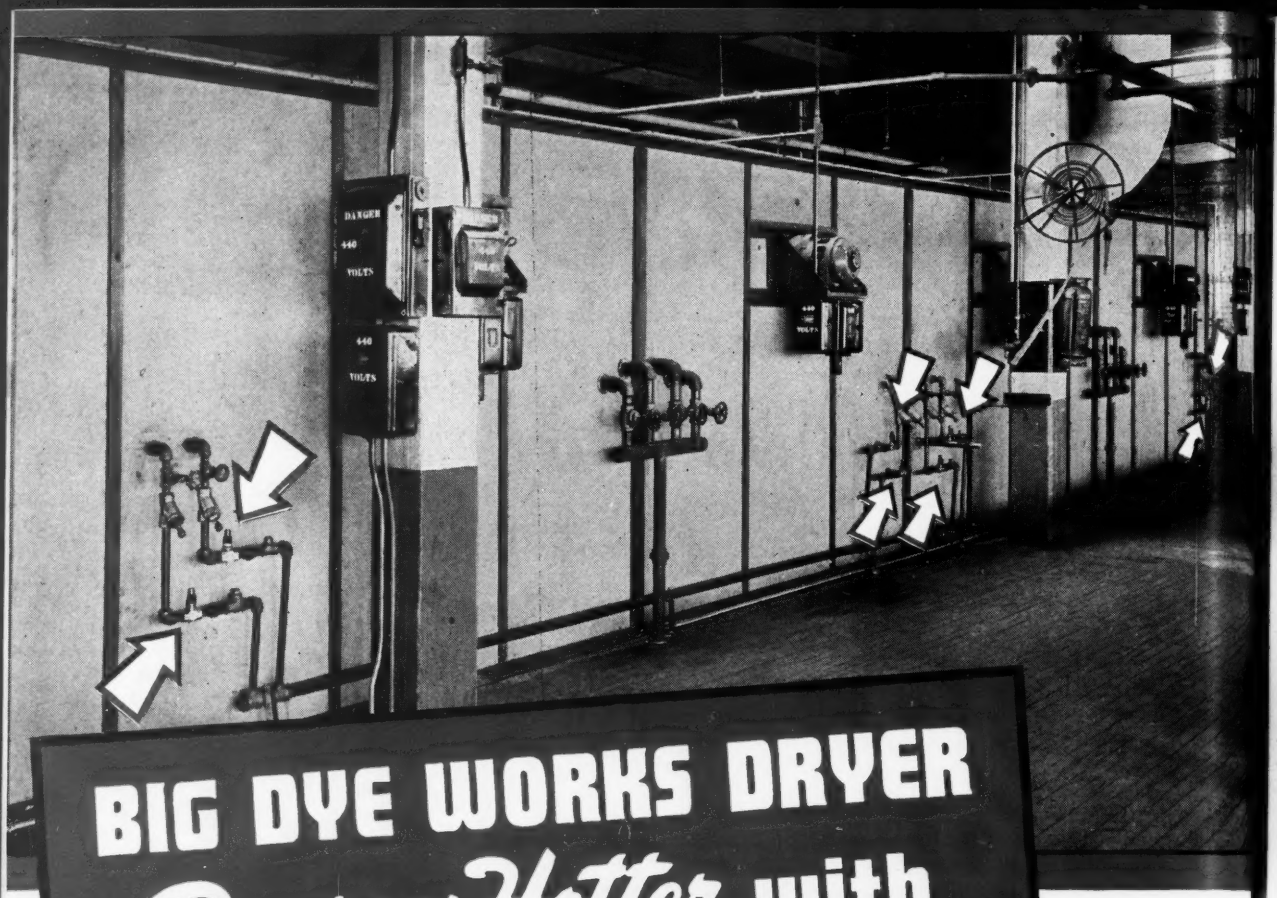

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YARWAY IMPULSE STEAM TRAP

WHAT LEADERS SAY

The Fostering of an Engineer

By JOSEPH SLEPIAN

MAN DOES NOT work in a vacuum, but lives in an environment of things, men, and ideas, which react on him and upon which he reacts. My own environment during my professional life has, in large part, been that aggregation of buildings, tools, money, men, ideas, and traditions, known as the Westinghouse Electric and Manufacturing Co., a corporation organized for manufacturing electrical machinery for the profit of its stockholders. That environment must have been propitious, or highly favorable to the development of such scientific talents as I had, or I probably would not be on this platform today.

A popular conception is that the organization of a large, successful company is like that of a smooth-running machine. Like the cogs, wheels, and levers of the machine, each man in the organization has his own clearly defined tasks and duties, which cooperate and fit in with the tasks and duties of other men so that the whole organization functions to perform that for which it was planned.

However, and in my opinion, fortunately this conception is true in only a very rough and approximate manner. If the organization is to be compared to a machine at all, it must be compared not to a well-tuned-up smooth-running machine, but rather to one with loose play in many places, the parts of which are held together at different points by the most various strategems, but which still lumbers along in spite of a wheel slipping here, a cylinder missing there.

For, unlike the cogs and wheels of the machine, which can be shaped precisely with close tolerance for their specific functions, the men who make up the organization are completely nonstandard. Everyone is different from every other one, and machine adjustment must be loose to accommodate itself to such variable parts.

This analogy with a machine thus becomes strained, but I shall strain it further by pointing out a quality possessed by the recalcitrantly nonstandard human cogs and wheels of the corporate organization but is absent in the precise cogs and wheels of the machine, and which makes the human organization a far more rugged, reliable, dependable, and adaptable organization, than the most perfectly-designed, inanimate machine could ever be. I have observed this quality frequently and have benefited by it continuously.

This quality of the human cog is his conscious awareness that he is part of the larger organization and that his particular task has purpose only in relation to the functioning of the larger organization. A carburetor is indifferent to whether its motor is running properly or not. Give it its proper adjustment, and it will continue to feed fuel to the cylinder regardless of whether the spark plug is firing or not. Not so in the human organization. When a human spark plug misses, the human carburetor alters his function, because he knows that while his set task is to feed fuel, there is no purpose in this if the spark plug is not carrying on his appointed task. Without this quality of humans, no complex organization, however carefully worked out, could ever function.

I must have been a particularly odd-shaped piece when I tried to fit into the Westinghouse organization in 1916, for very early I had reason to be thankful for the necessary looseness of organization. After working in the shops as an apprentice for most of a year, I started "on regular" as an assistant in "high-tension test," a works laboratory in the electrical section of the research engineering department. This laboratory made various tests for the engineering and purchasing departments, including a general oscillographic service. As I remember, my first job was measuring the resistivities of a big pile of sheets of German silver.

In this laboratory I came into contact with a number of engineers from various departments. Friendly chats grew into lengthy technical discussions. More engineers came, and presently I was carrying on a lively consulting service from "high-tension test." C. L. Fortescue was a frequent visitor, and he would sit for hours talking and working out with me some of his latest ideas. My pile of German silver strips lay waiting, untouched. The laboratory foreman, H. H. Galleher, a most kindly and lovable gentleman, would pass by and look on. I would be uneasy, because my set task, the measuring of those German silver strips, was being neglected, but there was never a complaint nor reprimand from Mr. Galleher. I don't know how he adjusted his time sheets. Perhaps the normal four-hour German silver job slipped in as 10 or 15 hours. But there was enough looseness, so that it could be taken care of.

I am sure that when the organization was planned, a consulting service at "high-tension test" was not contemplated, and I am also sure that at no time did any organization chart show such a service going on. But there it was just the same, thanks to the inevitable looseness of the organization, and thanks also to Mr. Galleher's awareness that the set tasks of the laboratory had significance only in relation to the larger organization.

Mr. Lamme, with whom I had occasional very inspiring talks, held the position of chief engineer. As such, he had responsibility for all engineering activities of the company. But his health was beginning to fail, and it was impossible for him to attend personally to all the details called for by his position according to the organization chart. Nevertheless, he continued to occupy that position until his death a few years later, giving of himself generously where he could. The job simply adjusted itself to this great man, chart or no chart.

I hope that I have not overstated my case and given the impression that I am arguing that any and all organization is undesirable in any enterprise, however complex. That would be absurd. An enterprise involving many men must have assignment of tasks, duties, and responsibilities to various individuals if the enterprise is to function, and such assignment of duties and responsibilities is what is meant by organization. But what I do say is that it is impossible to define these individual tasks and duties in complete detail and still fit individual men in all their variability.

This interesting comment on the relations of an engineer to a large organization in which he works was made by Joseph Slepian on the occasion of the award to him of the AIEE Lamme Medal for 1942, made at the recent AIEE national technical meeting in Cleveland as reported in Electrical Engineering. Dr. Slepian is director of research, research laboratories, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. He was born in Boston, was graduated from Harvard University and then studied at Gottingen, Germany and the Sorbonne in Paris. He has been awarded degrees of AB, AM and PhD. He taught mathematics at Cornell University and in 1916 joined the Westinghouse Company. Although educated primarily as a physicist and mathematician, he has become known primarily for his inventions and engineering work in the field of electricity. He has about 200 patented inventions to his credit and many more pending but is known chiefly for his development of the De-ion circuit breaker (based on an entirely new conception of methods of rupturing alternating currents) and of the Ignitron

Tracking Down Vibrations

Shown above is a modern Sherlock Holmes on the trail of undesirable vibration in an electric motor. He is using a new vibrograph, developed by the Westinghouse Research Laboratories which measures and records machinery vibrations in the range from 60 to 15,000 cycles per minute. Enclosed in a small box, and weighing only 8½ pounds, it can be used by placing it on the vibrating body, or, as shown in the photograph, hand held through the use of a prod. A newly devised timing mechanism leaves a trace on a celluloid ribbon, allowing calibration of the vibration. Its primary use is in connection with the tracking down of vibration in turbines, motors and motor-generator sets, and for certain plane vibration tests. Our knowledge of vibration and our ability to measure the rate, amplitude and quality of vibration of all kinds is in large part responsible for the success of large high speed rotating equipment. It is not very many years ago when a 3600 rpm turbine generator larger than 15,000 or 20,000 kw was scarcely thought of. Today, we build units of 40,000 kw running at this speed as a matter of course. Though the rotating masses of these machines weigh many tons, because of the thoroughness with which these masses are balanced as a consequence of our knowledge of vibration, a person standing alongside one of these machines can hardly detect whether it is running or not. The vibration recorder shown above is only one of many instruments available today for the measurement and analysis of vibration and noise, for noise, is in most instances the result of vibration in the audible range.

WITH THE EDITORS

◆ **ELECTRONICS**—In all the current hullabaloo about "electronics" it is, no doubt, difficult for the engineer who knows a little but not very much about the subject to separate the wheat from the chaff. He, probably, has a feeling that much of what he reads in the public press and in current advertising is pure baloney but his knowledge of the subject is too limited to back his hunch with facts. If he knows anything he knows that the science of electronics, if it can be called such, is not new, as much of present-day advertising and comment by non-scientific writers imply it is. Indeed, if he had never read anything but POWER PLANT ENGINEERING, he would recall an entire series of articles on electron tubes which appeared in these pages from 1936 to 1939, long before the general advertising men seem to have heard of electronics. In this, we are not referring to the advertising of legitimate electronic equipment in the technical publications but to the sensational type of advertising now appearing in the general magazines and newspapers. He would also know that electronics was born of the communication field—radio and wire telephony—and that many electronic devices were quite highly developed in the early 1920's. If he is historically minded, he probably knows that Edison discovered the Edison Effect in 1882 and that in 1904, Professor Fleming made the first practical use of this effect in his Fleming valve or what we know today, as a diode detector tube.

◆ **THE GLAMOUR OF IT**—What he does not know, however, is to what extent the sensational predictions now current may be accurate. Is electronics really going to revolutionize the post-war world as is implied and, if so, what should he do about it? Aside from the melodramatic applications of electronics in our post-war homes of which we are assured, there is much innuendo concerning revolutionary industrial uses. It appears, we are not going to do anything the old way after the war. In our homes, we are not going to turn lights on or off any more; instead, photocells will be in effect to bathe the home in a flood of constant level illumination, doors will fly open at our mere approach, television will provide entertainment and in the kitchen, the "little woman" will no longer sweat out her loveliness over hot ranges; instead, she will cook electronically. She will bake bread, to say nothing of cakes and pies, from the inside out. Garage doors will snap open at the approach of the family bus or helicopter. The bus itself, probably, will come to an electronic stop.

On the industrial side, we are given vague hints of high power industrialists sitting at massive desks, pressing buttons and looking at all parts of their vast factories by television—electronic television, of course. In the shops, electronics will reign supreme; everything is going to be under electronic control; plants will bristle with electric eyes and most everything we now have in the way of equipment is going to be a thing of the past—maybe.

The "maybe" is ours. Frankly, we believe the picture to be slightly cock-eyed. This, despite the fact that none can have greater faith in the future of electronics than we. Through an association and familiarity with tubes and electronic devices almost from the beginning as a consequence of a life-long interest in the technical aspects of radio, the writer feels that he understands something of the all but limitless possibilities of electron tubes but, by the same token, he knows, also, that the future application of electronic devices, as in the past, will be based, not on romantic notions of present-day visionaries but on the cold hard facts of economics.

◆ **GLAMOUR VS ECONOMICS**—As "Electronics" indicated in a recent editorial, "you can't sell electronics on glamour". Suppose it is possible (and it is) to bake a loaf of bread from the inside out by high frequency heating or to can fruits and vegetables at home by the same method, that is no reason such methods are going to be used. High frequency heat is expensive, necessarily so, and the cost of power needed to bake a loaf of bread would far outweigh the dubious convenience afforded by the method. As "Electronics" pointed out, also, any radio man can figure the cost of the apparatus required to make use of the process, and it is not cheap, brother.

The same is true of doors flying open under photocell control. It is intriguing, yes, and economical enough in Pennsylvania Station in New York where millions of people pass through such doors, but our guess is that it will be a long time before many of our homes, post-war or otherwise, are so equipped. Why? Simply because the doors are not opened by electron tubes but by motors or solenoids or compressed air or hydraulic cylinders. The control tubes needed, probably, cost only a few dollars, but the motors, gears and linkages necessary to actually open the door might cost fifty to a hundred dollars to install. We will be pushing doors for a long time to come, and why not, it's no great hardship.

This is not iconoclasm. Things will be and are being done electronically. In the case hardening of small steel parts for example, high frequency heat, electronically produced and under electronic control, does the job better and more economically than anything we have had before. Such parts are expensive and so it is perfectly economical to use expensive heat for their treatment. But not for baking bread in the home.

◆ **OLD STUFF**—Electronics is not new. In the communication field, electronic devices—amplifiers, oscillators, modulators and detectors—have been in use for three decades. In the industrial field, electronic control devices have been in use since the middle 1920's. Electrical manufacturers have been making and developing electronic equipment for many years. True, the war has given impetus to this development and has accelerated the process but, fundamentally, there is very little new in the field of electronics today that was not known ten years ago; there have been many refinements. Even the basic principles of the much kicked around "Radar" were known many years ago.

In short, there is no need to get unduly excited about electronics, or about plastics or any of the other glamorous, supposedly new developments. Electronics is already being used in the power and industrial field to an almost unbelievable extent. No one not familiar with the use of carrier current for communication, relaying, load control and telemetering on our power transmission systems can imagine to what extent such systems are under electronic control. In industry, electronic devices are, and have been, in use for years in the control of innumerable processes, ranging all the way from furnace temperature control in steel mills to the irradiation of food in food plants. Production welding as it is done, today, would be impossible without electronic control.

Except in the conversion of a-c to d-c in chemical plants and in the production of aluminum and magnesium, heavy currents are not being carried by electron tubes to any great extent. Thus far, in the power field, electronics is used almost entirely for control. In a number of instances, electronic rectifiers are used in the excitation of generators and synchronous condensers and this application will undoubtedly grow as will that of electronic motor control.

◆ **BEWARE OF DREAMS**—The process of development, however, will be orderly and along lines that have been established years ago. Our advice is to learn all you can about tubes and their application but to keep your feet on the ground of facts, not dreams. You will find that there are plenty of practical application of tubes to be made without any need to resort to rosy prognostications.

Keep in mind that while it is possible to do many things electronically, the mere fact that they can be done does not prove that they cannot be done just as well and perhaps more economically by existing, more conventional methods. The operation of any electrical circuit can be initiated by waving a hand across a beam of light directed into a phototube but except in cases where the actuating impulse is of necessity extremely small, a manually operated switch or push button or a magnetic or thermal type of relay will do the job just as well and a great deal more cheaply. In the power plant there are no doubt innumerable practical applications of electron tubes that will be worked out; certainly, electronic combustion control systems will be developed and motor drives will be controlled by tubes to an ever increasing extent but in all cases these applications will have to meet the competition of the older, established methods of control now in use. Remember, that the electron tube is inherently a high speed device and for this reason its most useful application is in systems and processes that undergo rapid changes. It is this quality coupled with their sensitivity that make tubes suitable where all other methods fall down. Finally, keep in mind that in the electron tube, you have a means of control that is unique—a link in the electric circuit, as W. C. White of G.E put it recently —free from the bondage of wires. That thought should be startling enough for anybody.

A.W.K.

Utilizing Exhaust Steam at Cast Armor Plant

At the new Cast Armor Plant of American Steel Foundries Co., East Chicago, Ind., a good balance between compressed air requirements and low-pressure process and heating steam demand has been achieved, as described here in detail. This has been done by installing steam-driven air compressors designed and connected so they can operate either condensing or non-condensing and thus supply both compressed air and exhaust steam to meet any desired plant conditions. Four 60,000-lb-per-hr, 175-psi, stoker-fired, bent-tube boilers, under complete automatic combustion control, generate steam for the compressors. An ingenious piping system, motor and turbine drives for draft fans, barometric condensers and continuous boiler blow-off system are other items of interest. An outstanding characteristic is the design of all buildings in modern industrial style, giving the plant a much different appearance from that of the usual foundry

ONE OF THE OUTSTANDING features of the recently completed Cast Armor Plant of American Steel Foundries Co. at East Chicago, Ind., is the utilization of exhaust steam from steam-driven air compressors.

Another outstanding feature is that this structure, erected with Defense Plant Corp. financing for operation by American Steel Foundries, departs from conventional foundry architecture in that the normal unsightly appearance of foundries is here replaced by a type of industrial design much like that in other fields.

Overall appearance and the many problems and details of construction were worked out jointly by the government, the operators and Albert Kahn Associated Architects and Engineers, Inc., whose founder's creed for many years was that beauty could be combined with utility at no extra cost in every type of industrial building.

The new war plant at East Chicago symbolizes this belief. The plant is modern in every respect, of steel, brick and concrete construction and with unusual facilities for the convenience and comfort of employees.

Buildings of Modern Design

All buildings in the plant follow, where practical, the same pleasing exterior design. Even in the interior of the main structure, the common dirt floor of a foundry is replaced by an 8-in. floor of concrete.

Construction of this main building typifies that of other units in the plant. The building, shown in Fig. 1, is of steel frame construction with common brick walls to the sills, 8 ft above ground, surmounted by three rows of continuous sash separated by strips of asbestos siding, 7 ft 2 in. wide. The cement tile roof is covered with tar and gravel.

Included with this main building are the open hearth and three foundry buildings, three cleaning and finishing buildings, six heat-treat buildings and a maintenance building.

There are eighteen monitors across the width of the main foundry buildings and eleven others on the roofs of the cleaning and

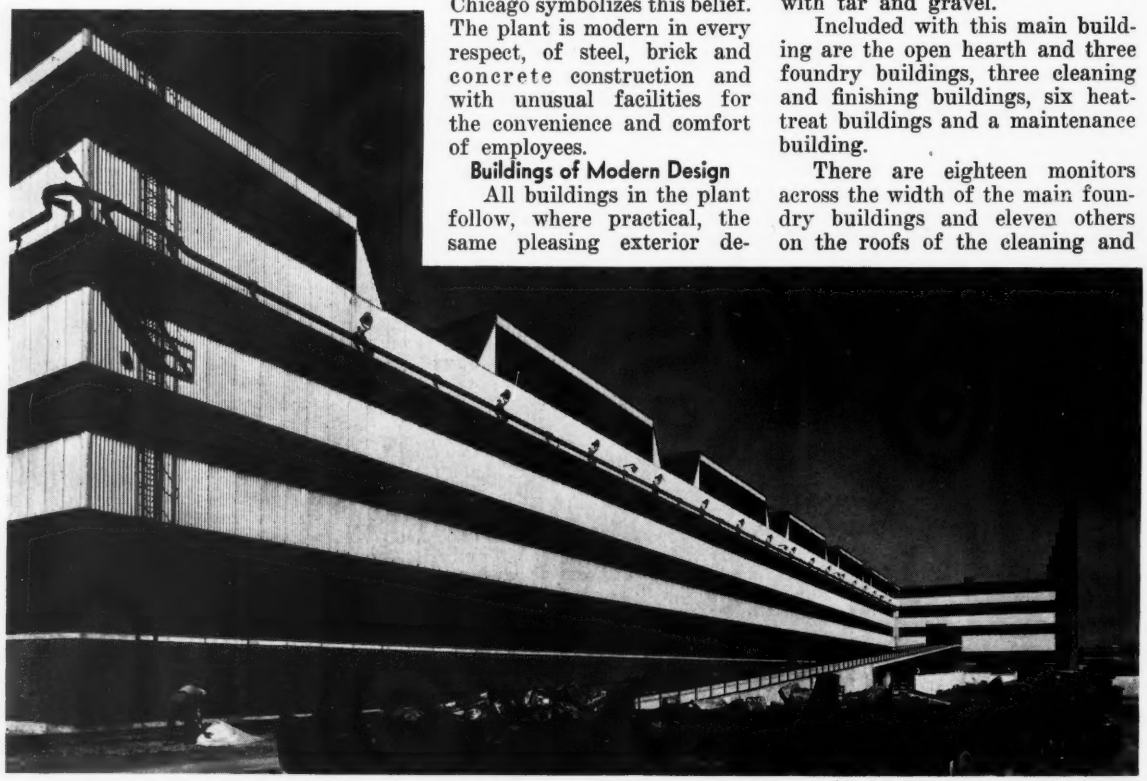

Fig. 1. General view of main building at new Cast Armor Plant of American Steel Foundries Co. showing modern design in keeping with present-day industrial standards

By

Paul Preuthun

and

P. N. Choporis

Mechanical Engineers—
Power Plant Division,
Albert Kahn Associated
Architects and Engineers, Inc.

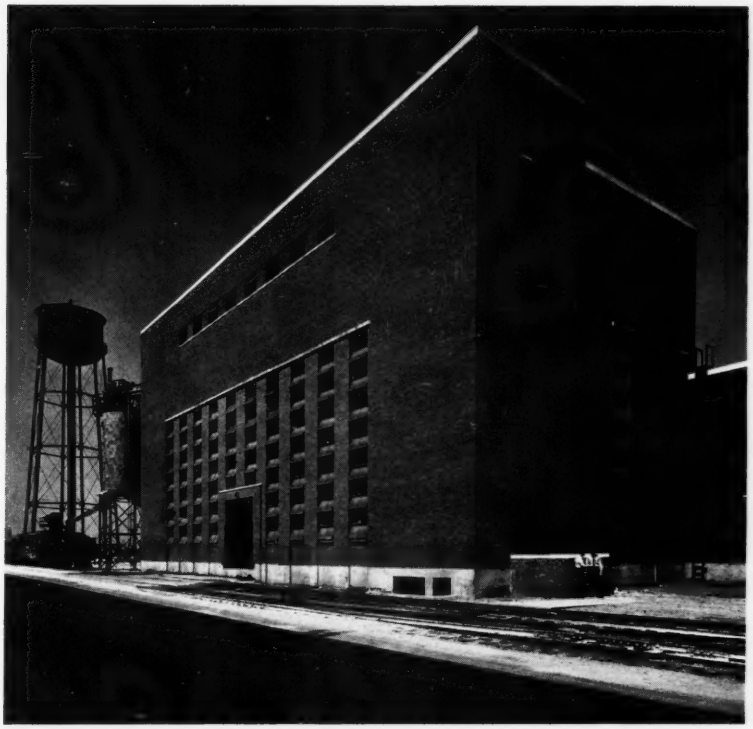

Fig. 2. (Right) Boiler and compressor house of modern design houses boilers, compressors and all necessary auxiliary equipment. Pneumatic ash system storage tank at farther corner

Fig. 3. (Below) Interior of boiler house, showing the four 60,000-lb-per-hr, 175-psi, stoker-fired steam generating units, with automatic combustion control panel in center. Weigh larry distributes coal to stoker hoppers from overhead concrete bunker

finishing buildings. All sash in sidewalls and monitors is equipped for blackout.

Auxiliary buildings and service units, in addition to the boiler house, include an oxy-acetylene house, fuel-oil tanks, fuel-oil pump house, pump and screen house and oil house.

The boiler house, Fig. 2, is of concrete frame to the boiler room floor, with steel frame, brick and sash above that.

The problem of balancing the compressed air requirements and the exhaust steam demand at this plant was solved by the installation of steam driven air compressors, which can be operated either condensing or non-condensing, depending upon the exhaust steam requirements in the plant.

Before describing the details of the air compressing and steam piping system in this connection, a short account of the boiler and compressor house mechanical equipment should be of interest.

The mechanical equipment consists principally of: four 60,000-lb-per-hr, stoker-fired, three-drum, bent-tube boilers, Fig. 3, operating at a saturated steam pressure of 175 psi gage; forced and induced-draft fans with motor and turbine drives; a direct-contact deaerating feedwater heater utilizing exhaust steam at 5 psi; both motor-driven and turbine-driven boiler feed

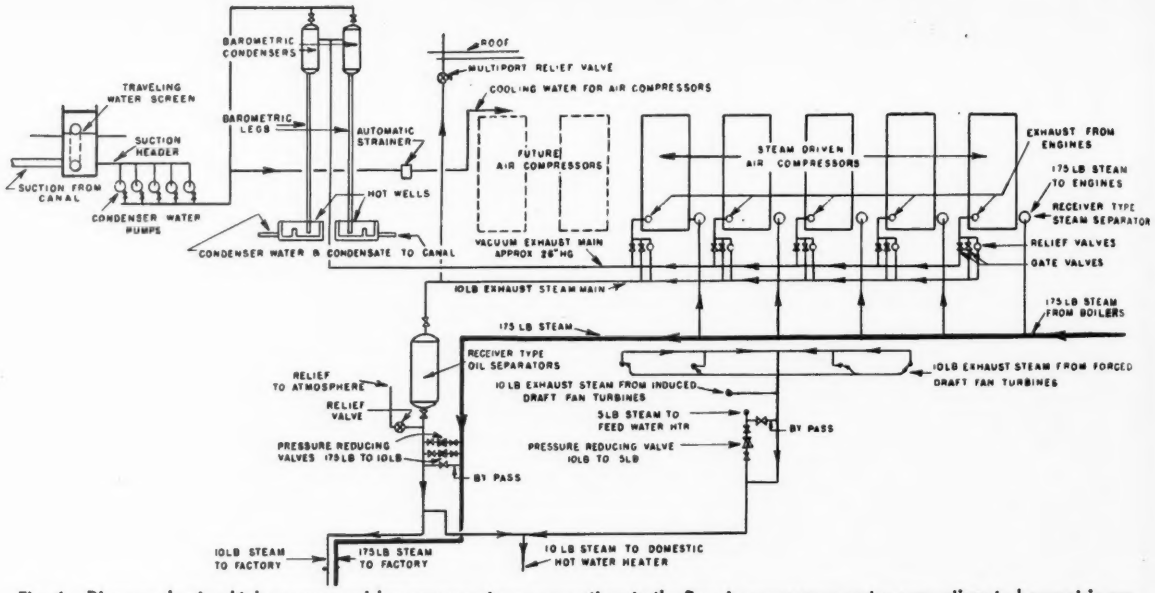

Fig. 4. Diagram showing high-pressure and low-pressure steam connections to the five air compressors, water connections to barometric condensers and provisions for any combination of condensing and non-condensing compressor operation

pumps; five 3900-cfm free air delivery compound steam-driven air compressors, Fig. 5, operating at a 110 psi air pressure, with space provided for two additional machines.

Coal and Ash Handling

Coal is delivered to the site in railroad cars and is unloaded, through a track hopper and the coal conveying system, to the concrete coal bunker located above the boilers and extending the full length of the boiler house. An additional track hopper and coal elevator are located a distance away from the boiler house and used to unload and distribute coal to the large outdoor storage pile. Coal from this pile may be reclaimed and delivered to the track hopper at the boiler house by the use of a bulldozer.

Coal from the bottom of the bunker is discharged through coal gates, located at several points along the full length of the boiler house, to a weigh larry, which weighs, records and distributes the coal to the stoker hoppers at each boiler.

Ash is removed by means of an automatic, pneumatic ash conveying system, which delivers the ash to an outside, overhead, ash storage tank provided with facilities for either railroad or truck unloading.

Boiler Auxiliaries

A complete automatic system of combustion control and metering equipment, consisting of master controller, fuel-feed, air-flow and furnace-draft regulators, steam flow meters, CO_2 meters and flue gas temperature recorders, provides the operators with the necessary means and data for safe and efficient operation.

A system of continuous boiler blow-off, consisting of heat exchanger, which utilizes the heat from waste boiler water to heat the boiler make-up water, flash tank with control apparatus, which collects the flash steam from boiler water and distributes steam to steam supply to feedwater heater, and sample cooler, together with an internal boiler chemical treatment system, maintain the boiler concentrations to the recommended requirements.

Air Compressor Operation

Through a unique system of piping, shown diagrammatically in Fig. 4, the air compressors are piped in such a manner as to permit either condensing or non-condensing operation for any combination of machines.

When operating condensing, condenser water from the nearby canal, which parallels the boiler house, passes through a traveling water screen and is then pumped by a combination of low-head, centrifugal, condenser water pumps, ranging in capacity from 350 gpm to 1500 gpm, to the two disc-flow-type barometric condensers located outdoors against the side of the boiler house. Condenser water piping and control valves, steam jets and controls for air and vapor removal from condensers, and drain piping from condenser hot wells, are all located inside the boiler house for quick access and maintenance.

All steam supply and exhaust piping in connection with the steam driven air compressors is installed in a pipe space under the operating floor, gate valves on each steam and exhaust line being operated by floor stands from the operating-floor level.

Relief valves with water seals are installed on the exhaust line from each engine, to protect the low pressure cylinders against excessive back pressure.

Each engine driving the compressors is rated at 736 Ihp at full load, with water rates of 13.6 lb per Ihp for condensing operation and 22.8 lb per Ihp for non-condensing operation.

Exhaust Steam and Compressed Air Demands

For supplying the average compressed air demand, four air compressors are operated at full load, giving an available exhaust steam capacity of approximately 67,000 lb of steam per hour at 10 psi gage. To this is added approximately 26,000 lb per hour of exhaust steam from boiler house steam-driven auxiliaries, such as boiled feed pump, forced and induced draft fans, etc., making a total of 93,000 lb per hour.

The normal average low-pressure steam requirements during the greater part of the year are approximately as follows:

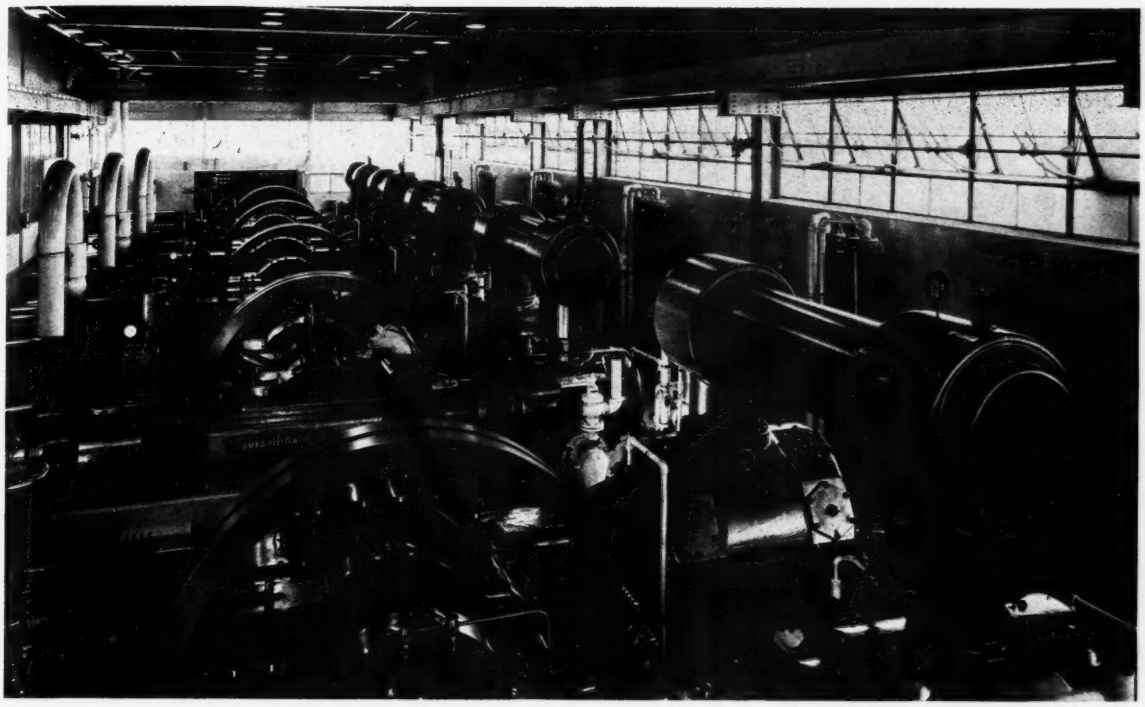

Fig. 5. View of the five air compressors, each driven by a 736-Ihp steam engine, operating condensing or non-condensing as required

	Lb per hr
Space heating and ventilation..	60,000
Domestic hot water heating....	15,500
Feedwater heating	12,500
Process, and miscellaneous.....	10,000
	98,000

It is evident from the above figures that a good heat balance is attained by this arrangement.

During the periods of low demand for exhaust steam, one, two, three or sometimes four of the compressors are operated condensing, depending upon the demand for exhaust steam.

Air intake and discharge piping is also located in the pipe space below the operating floor. A large diameter pipe, running full length of the compressor house, connects with the intake connection to each compressor through a blast gate.

Filters and Other Auxiliaries

The two ends of the main intake header connect to two filter houses located outdoors, and provided with blast gates at each intake connection. Each filter house is designed for 75 per cent of the maximum free air capacity, so that one may be shut down for cleaning and replacing air filters while the other remains in operation.

One large vertical aftercooler and air receiver are installed with each air compressor, aftercoolers being located indoors adjacent to each compressor, while the air receivers are outside close to the building wall.

Cooling water for the jackets, intercoolers and aftercoolers is also canal water and is supplied by the same pumps supplying the barometric condensers, except that cooling water passes through a fine-mesh, automatic self-cleaning strainer. Waste water is connected to the main condenser water discharge line to the downstream side of canal.

The domestic hot water heating system is also located in the boiler house. Exhaust steam at 10 psi is used to heat the domestic hot water supply for factory use. A combination system of a storage-type, hot water heater and two instantaneous type heaters, with automatic temperature control and pneumatically operated mixing valves, provides ample hot water at the desired temperature at all times. Hot water circulating pumps circulate the hot water to all points throughout the entire plant.

Principal Power Plant Equipment, Cast Armor Plant, American Steel Foundries Co.

Boilers	Union Iron Works
Feedwater Heater	Cochrane Corp.
Boiler Feed Pumps	Ingersoll-Rand Co.
Coal-Handling Equipment	Fairfield Engineering Co.
Stokers	Detroit Stoker Co.
Induced-Draft Fans	B. F. Sturtevant Co.
Forced-Draft Fans	Clarage Fan Co.
Air Compressors	Ingersoll-Rand Co.
Barometric Condensers	Ingersoll-Rand Co.
Condenser Water Pumps	Fairbanks Morse Co.
Traveling Water Screen	Chain Belt Co.
Multiport Relief Valves	Cochrane Corp.
Continuous Blow-off System	Cochrane Corp.
Receiver Oil Separators	Cochrane Corp.
Steam Separators	Cochrane Corp.
Combustion Control and Metering	Republic Flow Meters Co.
Turbines Driving F.D. and I.D. Fans	D. E. Whiton Machine Co.
Motors Driving F.D. and I.D. Fans	U. S. Electric Motors, Inc.

The Topping Program at SHERMAN CREEK

Part III

In this final article of a series of three, we present the details of the condensate system of the Sherman Creek topping unit together with a description of the boiler feed pumps and their control

By H. Knecht *Division Engineer,*
Consolidated Edison Company of New York, Inc.

HAVING DESCRIBED the boiler and the turbine generator of the initial development of the topping program at Sherman Creek in the September and October issues, we will now consider the condensate system and the details of the boiler feed pumps and their control.

The general path of the condensate can be traced either on the flow diagram or the heat balance diagram shown in Part II in the October issue. Condensate from the low pressure turbine hot well pumps is discharged into a common header feeding both the open heaters in the old station and the direct contact heater in the high pressure station.

The control is arranged to feed only condensate to the direct contact heater. All condensate over and above that required for the high pressure system, and necessary make-up water, flows to the open heaters in the low pressure station. At least two low pressure boilers are in operation at all times to supply steam in case of emergency to drive the high pressure boiler feed pump turbine, main turbine auxiliary oil pump and for the direct contact heater air ejectors.

The direct contact heater is an Ingersoll-Rand vertical disc-flow type, equipped with an integral pre-cooling chamber, a storage hot well, an ejector for normal operation and a hogging ejector for starting up. This heater operates at a pressure of 4 psi absolute, condensing approximately 20,000 lb per hr of exhaust steam from the high pressure boiler feed pump turbines. In addition to condensate, this heater is provided with emergency connections for supplying treated water and city water.

Deaerator

For pumping condensate from the direct contact heater to the deaerator, two condensate booster pumps (one motor driven and one steam driven spare) have been provided. The deaerator is an Elliott contact tray type and has a rated capacity of 1,100,000 lb per hr of condensate measured at the discharge. This heater is equipped with two vent condensers set in parallel and valved, to permit either one to be isolated for overhauling, without taking the deaerator out of service. Heating steam at approximately 3 psi gage is supplied from the nearby induced draft and forced draft turbine exhaust, the balance from the station auxiliary exhaust header. High pressure closed feedwater heater condensate returns are also flashed into the shell above the water level.

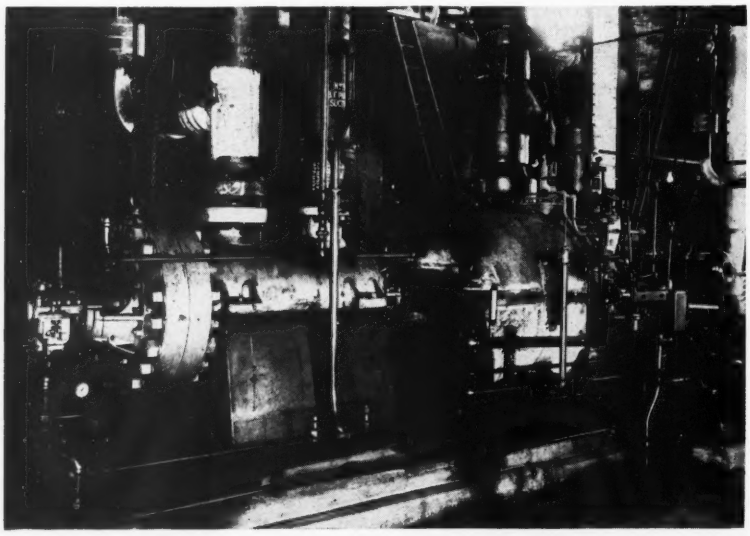

Fig. 1. One of the high pressure boiler feed pumps and its driving turbine

Boiler Feed Pumps

From the deaerator condensate at approximately 222 F flows to the suction of the high pressure boiler feed pumps. The elevation of the deaerator is such as to maintain a positive suction head of at least 30 psi gage at the pumps. There are three turbine driven variable speed boiler feed pumps; two for full load operation and one spare. The pumps are Byron-Jackson 8-stage outer barrel and horizontal split inner volute case. The space between the inner volute case and outer barrel is filled with water at full discharge pressure of approximately 1800 psi gage, so that the outer barrel alone withstands the bursting pressure and is subject to tension stresses. The inner case is the conventional horizontally split volute type utilizing the discharge pressure to maintain the joints. The volutes are of double construction to lessen the radial loads and losses at low capacities. The impellers are of the opposed enclosed type, one half having the suction entrance on one side and the other half on the other side. Any minor unbalance axial thrust is carried by an oversized Kingsbury thrust bearing.

The pump is so designed that in case of emergency it may be put into immediate service without warming up. However a turning gear is supplied to rotate the unit at about 13 rpm, for warming up periods. The normal full load capacity of each pump is 460,000 lb per hr against a total dynamic head of 1800 psi gage, at a speed of 4150 rpm.

Boiler Feed Control

There have been three means provided for controlling feedwater to the boiler; automatic, remote manual, and local manual. The equipment is the Bailey Meter

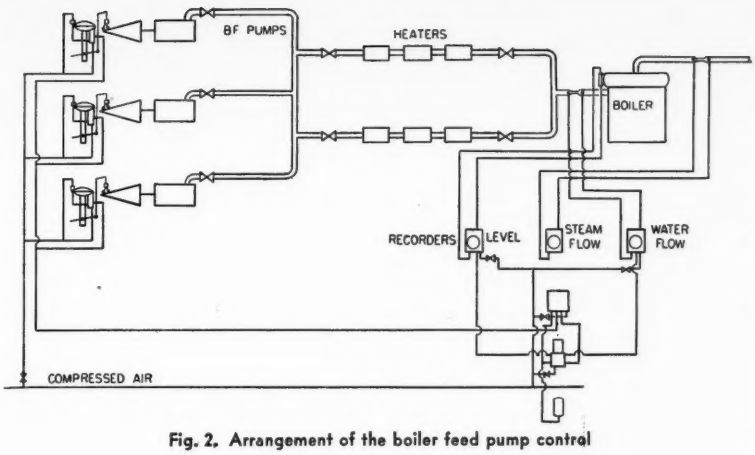

Fig. 2. Arrangement of the boiler feed pump control

Company's 3-element system and is arranged to regulate the speed of the boiler feed pump turbines. Included as part of the control are a steam flow recorder, feedwater flow recorder, and boiler drum level recorder. This 3-element system is designed to vary the speed of the boiler feed pump turbines so as to maintain a balance of water flow against steam flow, compensated by drum level variation. Steam flow and water flow mechanisms are connected together to jointly operate an air Pilotrol, the loading from which is increased for an increase of steam flow over water flow. The water level recorder mechanism operates a second Pilotrol, the loading from which increases with an increase of water level in the boiler drum. The above loadings are applied (one above and one below) to a diaphragm in the Standatrol so that the combined effect of steam flow, water flow and drum level are relayed into a control loading for operating the actuators at the feed pump turbines.

An automatic manual selector valve is loaded by the Standatrol and relays a control loading into the actuators. This control loading may be automatically or manually operated.

The automatic manual selector valve is on the boiler operating panel, located in the vicinity of the boiler feed pumps and affords a means by which the actuators at the feed pump turbines may be positioned manually from a remote point.

Local control of the feed pump turbines may be accomplished by means of a hand wheel above the diaphragm chamber on the actuator. The drum water level is visible from these control points through the sight gage system.

Boiler Feed Turbine

The boiler feed pump drive is a direct connected, condensing, controlled extraction type General Electric turbine having nine impulse stages—three above the bleed point and six below.

The turbine has a normal rating of 1357 hp at 4150 rpm with 185 psi 485 F steam to the throttle and exhausting into the direct contact heater at 4.0 psi abs. It will develop a maximum load of 1685 hp at 4340 rpm with the same steam conditions. This capacity may be required when carrying full load with only one set of heaters in operation. To take care of a starting condition where the exhaust must be to atmosphere and no bled steam is required, the turbine has been designed to develop 738 hp at 3670 rpm with the same throttle steam conditions and 1.3 psi gage back pressure. This is the power required at ½ load at full boiler pressure and is in excess of that required during normal starting where the boiler pressure will be low until after bled steam is required.

The turbine is provided with a turning gear so that the spindle may be rotated at a speed of about 13.8 rpm when the driven pump is acting as a spare. This is operated during standby periods so that the turbine may remain uniformly heated and the spindle true.

The turning gear is driven by a 2 hp motor through a speed reducer with a ratio of 63 to 1. The worm shaft is extended to drive an oil pump which furnishes oil for control and bearing lubrication during turning gear operation. This oil pump also acts as a back-up for the shaft driven main oil pump through the action of a pressure switch which automatically starts the turning gear motor on loss of oil pressure. The turning gear is manually engaged, automatically disengaged.

During operation on turning gear, the gate valve in the exhaust is open so that the pump may be started up by opening the throttle valve. The turbine glands are steam sealed, provision being made to use live steam from above the throttle valve seat during stand-by periods.

During normal operation, control and bearing oil is furnished by a geared type positive displacement, valveless pump driven from the turbine shaft at a speed about 15 per cent that of the turbine.

Flow of steam to the turbine is controlled by five poppet type admission valves actuated by a spring loaded piston. The flow of steam to the exhaust end is responsive to the bleeder pressure.

A hand speed changer has been provided to allow manual control of the turbine speed when the automatic control is not being used. This hand control may be used to hold speed at any point between 3500 and 4500 rpm. When on automatic control, this speed changer is set at a speed slightly above the expected maximum required so that in case of failure of the automatic control the pump will continue to supply the required water at a slightly higher pressure.

The governing mechanism on these boiler feed pump turbines is designed so that the pumps will supply the required feedwater and at the same time the turbines furnish the necessary steam for feedwater heating in the 75 psi heaters. The pumping requirements are met by the connection to the Bailey feedwater regulator. The steam requirements for the heaters are met by the extraction pressure control which acts to maintain 75 psi in the extraction line, by adjusting the grid valve to allow more or less steam to flow to the low pressure end of the turbine. As an adjustment either by the Bailey regulator or the extraction pressure governor will require some compensating adjustment of the main control valves, the various controllers are interlocked.

Referring to Fig. 3, this control system performs in the following manner:

(a) Where the extraction steam requirements are constant,

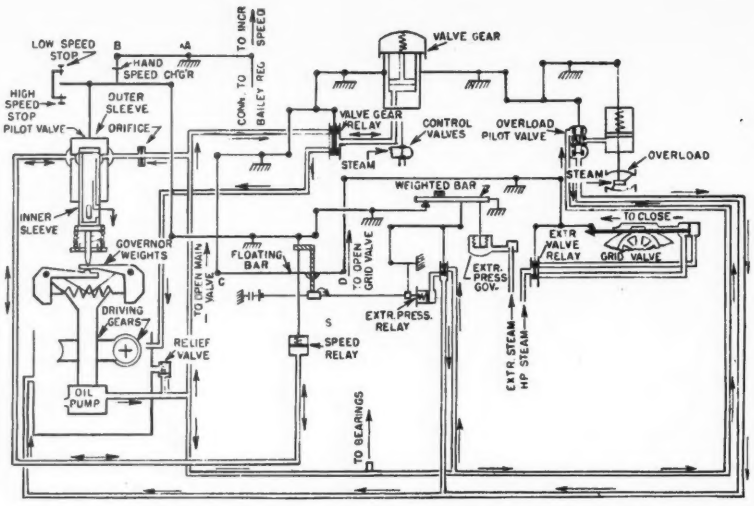

Fig. 3. Diagram of the governing mechanism of the boiler feed pump turbines

and the pumping load is increased, requiring an increase in speed, the Bailey regulator moves up to increase speed. Rotating about fulcrum "A," the left end "B" of the lever moves down and lowers the outer sleeve of the pilot valve, thus increasing the control oil pressure, and opening the admission valves.

At the same time the right hand end "D" of the floating bar is raised. This motion is transmitted to the extraction valve relay, lowering its piston and allowing steam to move the grid valve piston in a direction to open the grid valve. This increases the amount of steam to the exhaust end, increasing the speed and power without change of bleeder pressure.

As the speed increases the governor weights swing out, reducing the control oil pressure. This action, combined with the return linkage, establishes an equilibrium in the control system and the turbine will operate at the speed and load required by the Bailey control.

When pumping load and speed is constant, and an increased extraction flow is required, the operation is as follows:

With the increased requirements for bled steam, the extraction pressure will drop, allowing the weighted bar to drop, which in turn lowers the extraction pressure relay pilot valve. This allows the oil to move the piston to the left, thus rotating the floating bar in a clockwise direction. This lowers the right end "D" of the bar and this motion is transmitted to the grid valve relay, lifting the relay piston and closing the grid valve. This reduces the flow to the exhaust end, thereby increasing the pressure. As the power derived from the exhaust steam is less, the main control valves must open somewhat to compensate for the power reduction.

To accomplish this, as the floating bar rotates in a clockwise direction, the left end "C" is raised and this will open the control valves.

It is to be noted that to increase speed and load the floating bar is lifted by the speed relay, opening both main and grid valves. If necessary extraction pressure relay will readjust the extraction pressure by tilting the floating arm, thereby changing the ratio of grid valve opening to main control valve opening.

Extraction pressures adjustments are made by shifting the weight "W" on the weighted bar. If the Bailey regulator is not in service, that end of the lever is locked in position and speed adjustments made by hand.

The overload valve operates only if the main control valve cannot maintain speed. In this case the valve gear continues to move up and through the levers, lifts the overload relay valve. This permits oil to flow under the overload valve piston and open the overload valve.

The speed relay, the extraction pressure governor, the extraction pressure relay, the weighted beam and the floating bar, with their interconnecting links, form the 3-arm mechanism.

From the common boiler feed pump discharge header the water is pumped through two parallel rows of closed heaters. Each row consists of one low pressure heater using steam at 70 psi gage from the boiler feed pump bleed; one intermediate pressure heater using steam at 195 psi gage from the high pressure turbine exhaust; and one high pressure heater using steam at 390 psi gage from the high pressure turbine extraction point. Under normal conditions, the total flow of feedwater is handled through both rows of heaters. However, the piping and valves are so arranged that in case of necessary outage one row can be isolated by gate valves set ahead of the low pressure and beyond the high pressure heaters. Under this condition full flow is passed through one row of heaters resulting in an increased pressure drop.

Closed Feedwater Heaters

These heaters are of the Westinghouse vertical "U" tube removable shell type. Each heater is provided with an integral drain cooling section. In addition the high pressure heaters are provided with a desuperheating section.

The condensate drains down through the inlet head or water channel to a separate level controlled hot well, thence through external interconnecting piping to the lower end of the heater drain cooling section. From here the condensate is drained to the next lower stage heater.

The drain cooling section of the low pressure heaters is designed to pass a maximum condensate flow corresponding to full load normal operation, and to by-pass externally condensate above this figure, particularly when one battery of heaters is out of service. The drain cooling sections of the other heaters are designed to pass condensate under all operating conditions.

Diaphragm valves actuated by liquid level controllers serve to regulate the flow of condensed steam from the six hot wells of the high, intermediate and low pressure closed feed water heaters so that a level of condensate will be maintained in each hot well within a predetermined range of about 6 inches.

Except for a few shutdowns, for minor adjustments, the equipment has been operating continuously and satisfactorily since its initial startup, and present indications are that the expected heat rate will be attained.

Uses For Three-Dimension Pictorial Drawings

No doubt, before you even read these lines you will have been impressed by the beauty and perfection of the drawings accompanying this article. The halftone reproductions are good but one really should see the original pencil drawings from which the halftones are made. As explained by the authors, these drawings are useful as well as attractive. They illustrate a new idea in engineering drawing which may be found as useful in other organizations as it has in the engineering department of the I-T-E Circuit Breaker Co. in Philadelphia.

By J. A. C. Krips & W. S. Miller

Project Engineers, I-T-E Circuit Breaker Company, Philadelphia, Pa.

MUCH HAS BEEN SAID and written regarding the recent successes of three-dimension pictorial drawings as production expedients because of the easy visualization they afford, but the application is not limited to production, for they can be employed by any engineer to convey his ideas more effectively. The engineer often instinctively makes a three-dimension sketch to clearly show the interpretation of an engineering drawing, and in so doing he is applying the principle of pictorial drawings.

At I-T-E orthographic projections have been successfully utilized for over 50 years, but pictorial drawings have proved so valuable in 6 months that they have become a permanent engineering tool to supplement regular drawings.

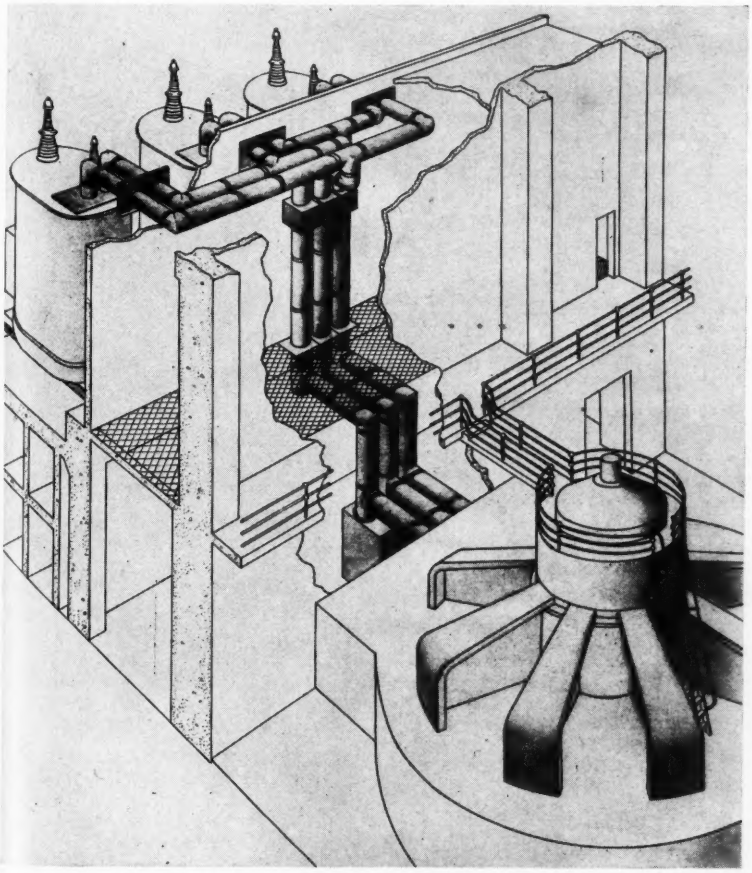

Fig. 1. Cutaway view of metal-enclosed bus run, showing limitations imposed by structural design

Preparation

From sketches checked with instruments for proportion and perspective, penciled pictorial drawings are made. Photographic reproductions are used for the various applications.

Commonly called production illustrations or graphic illustrations, they are prepared by commercial artists schooled in the necessary engineering fundamentals. Draftsmen could probably be given training in perspective three-dimension sketching in order to become graphic illustrators, but they cannot be spared.

Advantages

The effectiveness of pictorial drawings results from the easy and fast reading obtained when just one view is used. The elimination of the intermediate process of harmonizing three views simplifies the reading and reduces the possibility of error. The use of a physical rather than a mental picture gives a clearer and more complete conception of what is meant and leads to uniformity of interpretation. Especially in the case of intricate shapes and details, three-dimension drawings are effective in giving a vivid picture of shape-description and part relationship.

Pictorial drawings produce a rapid reaction that arouses interest, which might otherwise remain dormant, and hastens a meeting of minds. Also they supply the one deficiency of engineering drawings —the coordination of three views into one.

Present Use

Pictorial drawings are playing a prominent part in the solution of the training problem at I-T-E be-

cause they can be so easily read. They are also helping immensely in the task of producing quality switchgear in short time by supplementing regular engineering drawings in certain manufacturing practices, for planning the sequence of assembly operations, and for the actual assembly. Their use has assisted in obtaining the desirable uniformity of both process and product that makes for ease of production, installation, and maintenance.

In addition, pictorial drawings have been effectively used for subcontracting to avoid varying interpretations of the same drawings. They have also been used with the advantages of speed and economy in place of models when purchasing, for example, a molded bakelite case of design so intricate that engineering drawings could not be used to convey visualization of the shape. In the development of new apparatus they are being used in order to most effectively show possibilities, and also to show details and integration of the parts.

In certain instances, pictorial drawings are currently being used at I-T-E to replace photographs in production, records, sales, and advertising. Photographs usually have some highlights and shadows in unwanted places. Retouching is expensive and not always satisfactory. Pictorial drawings allow the emphasis and subduing effects to be placed where needed to give the desired picture.

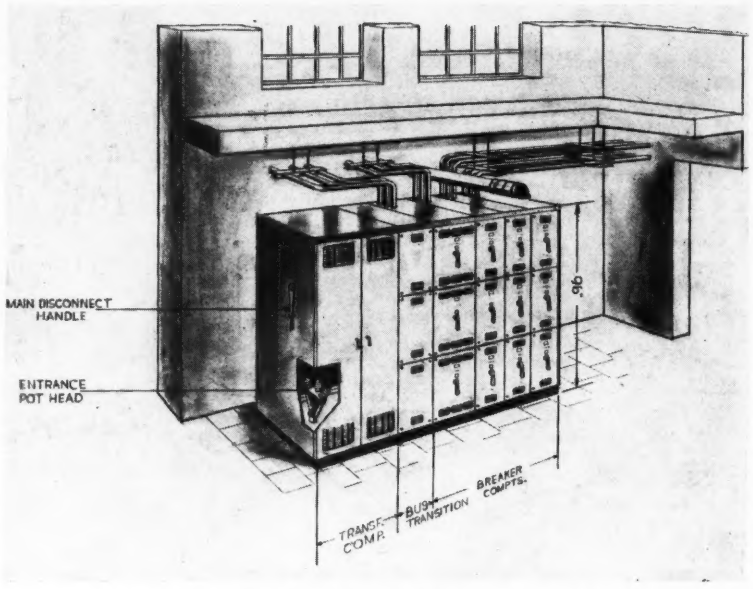

Fig. 2. Unit substation, using cutaway view to disclose pothead, and showing obstacle in path of low-voltage feeders

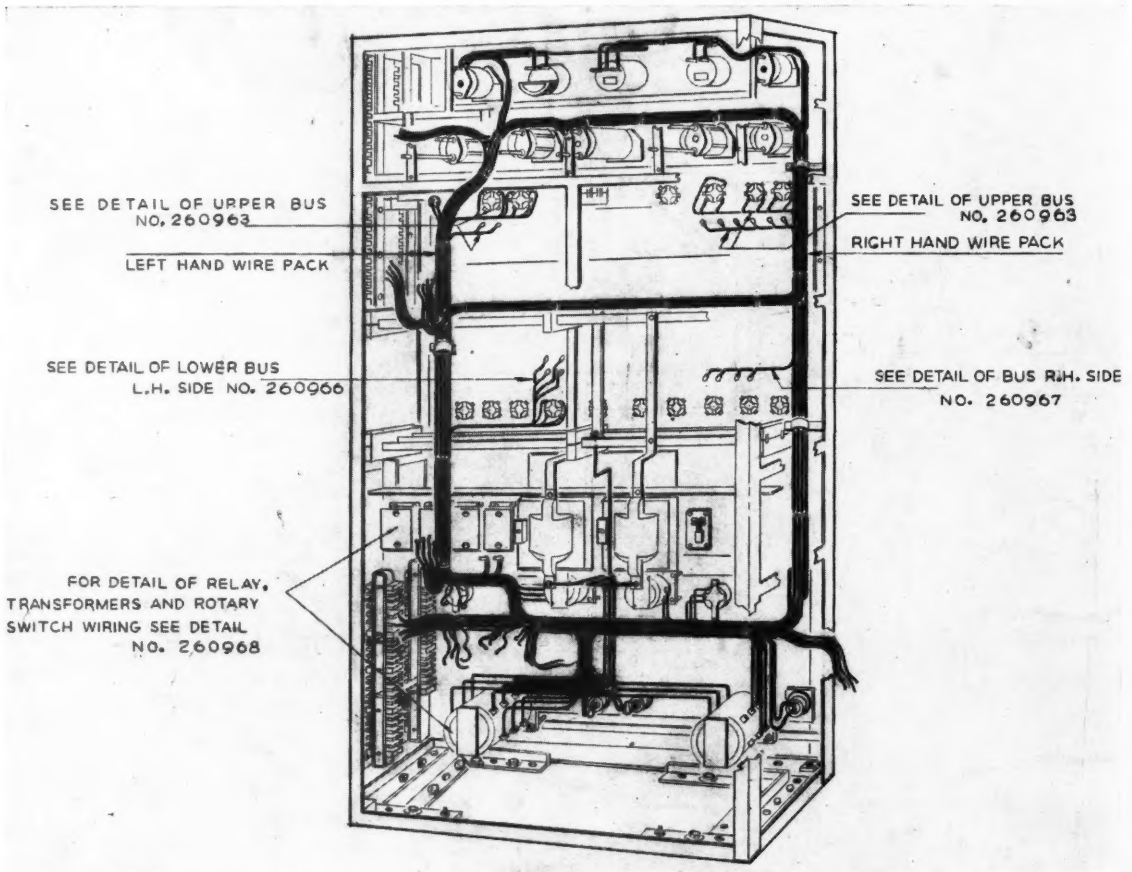
SEE DETAIL OF UPPER BUS NO. 260963
LEFT HAND WIRE PACK
SEE DETAIL OF LOWER BUS L.H. SIDE NO. 260966
FOR DETAIL OF RELAY, TRANSFORMERS AND ROTARY SWITCH WIRING SEE DETAIL NO. 260968
SEE DETAIL OF UPPER BUS NO. 260963
RIGHT HAND WIRE PACK
SEE DETAIL OF BUS R.H. SIDE NO. 260967

Fig. 3. Rear view of one frame of switchboard to reveal arrangement of wire packs; all other details subordinated. Enlarged views of each portion of frame (not shown) are used to show wiring of instruments and controls

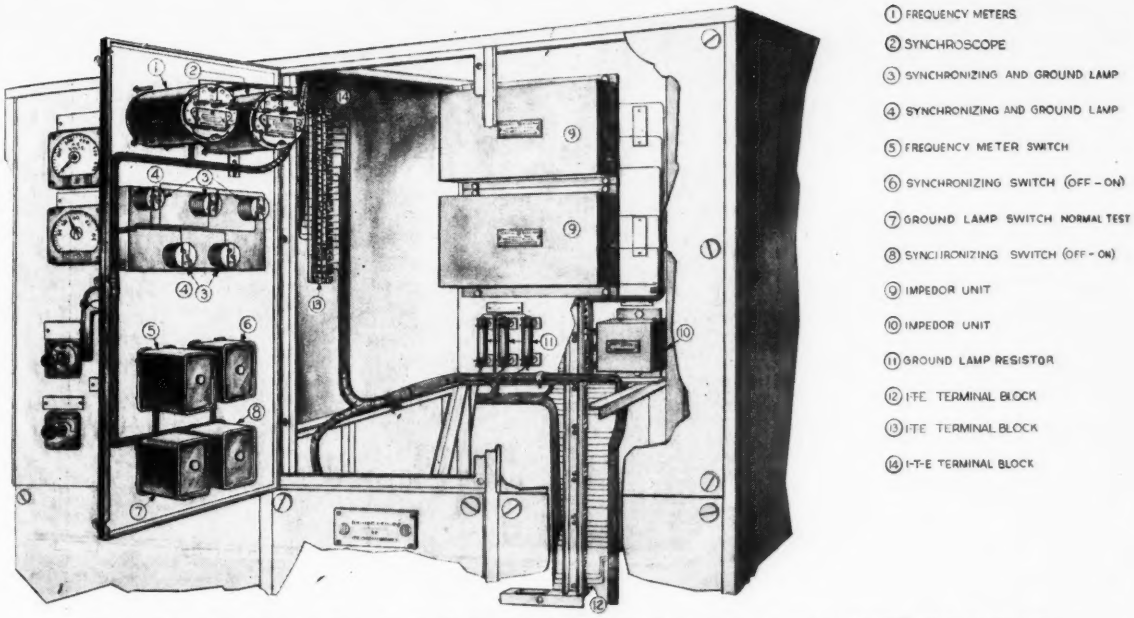
① FREQUENCY METERS
② SYNCHROSCOPE
③ SYNCHRONIZING AND GROUND LAMP
④ SYNCHRONIZING AND GROUND LAMP
⑤ FREQUENCY METER SWITCH
⑥ SYNCHRONIZING SWITCH (OFF - ON)
⑦ GROUND LAMP SWITCH NORMAL TEST
⑧ SYNCHRONIZING SWITCH (OFF - ON)
⑨ IMPEDOR UNIT
⑩ IMPEDOR UNIT
⑪ GROUND LAMP RESISTOR
⑫ I-T-E TERMINAL BLOCK
⑬ I-T-E TERMINAL BLOCK
⑭ I-T-E TERMINAL BLOCK

Fig. 4. Front view of one portion of a distribution switchboard with door open for complete identification of all parts

These proved, practicable advantages of pictorial drawings loom as factors to make them a desirable means to use for the design and purchase of electrical switchgear and related apparatus. Before design of switchgear can be begun, there must be considered the space and position limitations imposed by the plan of the building, the placement of installed services, and the apparatus to which connections are to be made. These limitations are often difficult to convey by regular drawings. Occasionally special features are required or equipment other than standard is needed. Pictorial drawings provide a means for conveying complete information to the manufacturer so that he may design without a great deal of correspondence.

Supplant Models

Sometimes the layout of a station and location of apparatus is such that intermediate bus runs from generator to transformer are very costly affairs consisting of elaborate cross-overs and bends, if they are run solely from schematic drawings. Models have been successfully used to design stations and locate apparatus with a view to accommodating the bus runs. With far less cost and greater speed, three-dimension perspective drawings could be used for this purpose (Fig. 1).

The wide application of the principle of load-center unit substations provides a fertile field for the utilization of pictorial drawings for choice of both the physical position of the unit and the paths to be taken by the incoming and outgoing circuits. Besides, by means of cutaway views, any particular items located within the unit can be revealed. Limitations imposed by obstructions in the normal paths of the circuits and any special features can be clearly shown by means of pictorial drawings. (Fig. 2.)

Pictorial drawings rank with standardization of equipment and the use of one-line diagrams in saving time required to decide on switchgear for a job, order it, and get it into production. In addition, pictorial drawings can profitably be employed to help maintain switchgear at top-notch efficiency. Currently at I-T-E they are being applied to instruction books, repair parts lists, and maintenance manuals. Pictorial drawings allow the wiring and parts to be easily identified for rapid servicing. They show the wiring as it actually appears, giving a useful picture of the arrangement of wire packs and the paths taken by individual wires. They show the installed position of the parts and their relationship in a manner that is impossible by regular drawings. Front and rear cutaway views combine to give the operating engineer complete information in clear, concise fashion (Figs. 3 and 4).

Wherever engineering drawings are now being used there exists the possibility of applying pictorial drawings, either to supplement the regular drawings or to replace them entirely. There are in current preparation at I-T-E three-dimension drawings that are scaled so exactly that dimensions could be taken from them (if that were good engineering practice), and they will be used to replace engineering drawings in some particular cases. It cannot be done in all cases but it does have the advantage that one pictorial drawing will replace three conventional drawings.

FOR MULTIPLE expansion engines, the cylinder ratio is the relation of the displacement of the low pressure piston to that of the high pressure. As the stroke is the same in both cases, the ratio is the square of the low pressure diameter divided by the square of the high pressure cylinder diam eter. In practice this will range from 2.5 for noncondensing engines up to four, five or even six in condensing engines.

The ratio of expansion or the number of expansions of the steam is the ratio of the low pressure to the volume of the high pressure cylinder at the cutoff. It is, therefore, easy to prove mathematically that the expansion ratio is the product of the number of expansions in the high pressure cylinder and the cylinder ratio. As the number of expansions in the high pressure cylinder is the reciprocal of the cutoff in per cent, a more useful expression for expansion ratio is the cylinder ratio divided by the cutoff of the high pressure cylinder.

Thermostat Control For TRIPLE-RATED TRANSFORMERS

By H. A. MORGAN

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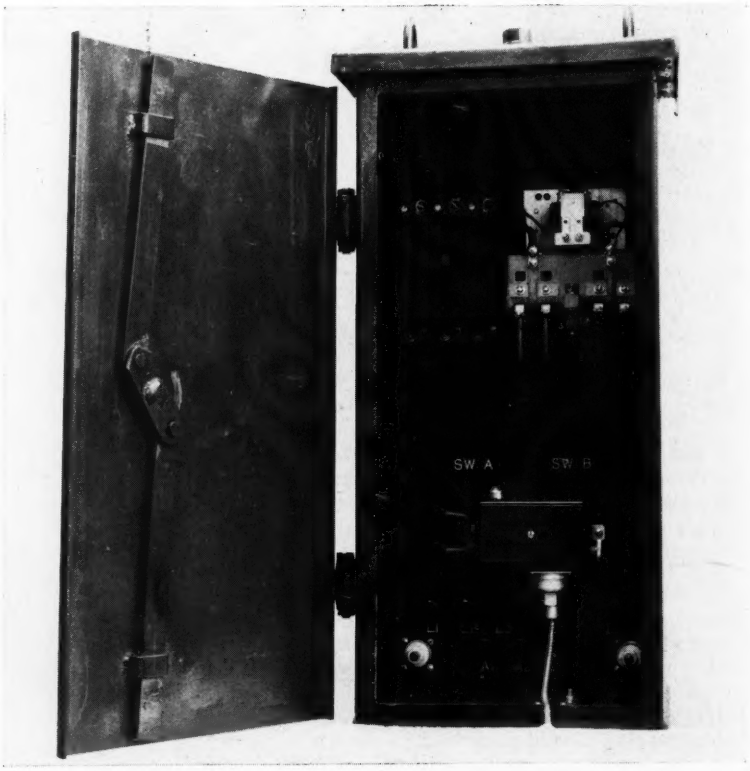

Fig. 1. Automatic, weatherproof control cabinet on transformer tank

Working hand in hand with the war program, Westinghouse has developed a triple-rated transformer, the primary object of which is to meet the present emergency calling for additional kilowatt capacity for war production plants.

TODAY, operating companies are confronted with the pressing demand for more capacity to meet war emergency loads. This live subject is the springboard for the release of many articles on the safe overloading of transformers. Manufacturers have recommended various methods of cooling to push the rating up and conserve critical materials. The efforts of manufacturers are directed to methods of obtaining required transformer capacities by increasing the rate of loss dissipation by fans and forced circulation of the oil to save critical material going into new units. For the present, economy of operation should not be an important factor. Even the expected life of a transformer may be shortened to secure the maximum output.

Working hand in hand with the war program, Westinghouse has developed a triple-rated transformer, the primary object of which is to meet the present emergency calling for additional capacity for War Production Plants.

With this design, there is an appreciable saving in critical material, vitally needed for arms and munitions, and yet, an emergency load can be carried for the duration with safety. Although there may be some loss of economy in operation at full capacity, there will be no sacrifice in the expected economic life of the transformer. When the need for the full rated output is behind us, the transformer can be operated economically with the normal load cycles and short time peak loads.

The three ratings are obtained by starting out with a conventional self-cooled transformer, except for a modification of the radiator arrangement. The second rating results by the addition of air blast equipment to the radiators. By forced oil circulation, the third rating is possible and the designation is self-cooled, forced air, forced oil cooled transformer.

An example will serve well to illustrate the application of the thermostat control that is employed. In a recent typical case, the long time emergency load for the duration of the war was 15,000 kva. In this case, the starting point is a 9000 kva self-cooled transformer. No automatic control for this rating is required.

As the load on the transformer increases above 9000 kva, the fans mounted on the radiators start automatically by a thermostat control actuated by top oil temperature.

Since the oil temperature is influenced by such factors as ambient temperature and winds, the fans may not come on until the load is well beyond 9000 kva. Also, fairly heavy short time loads can be carried without fan operation due to the heat storage of the oil.

The bulb of the thermostat projects down into the transformer oil through a standard pipe size fitting on the transformer cover. A flexible armored capillary tube connects the bulb to thermostat No. 1 mounted on the panel in the control cabinet,

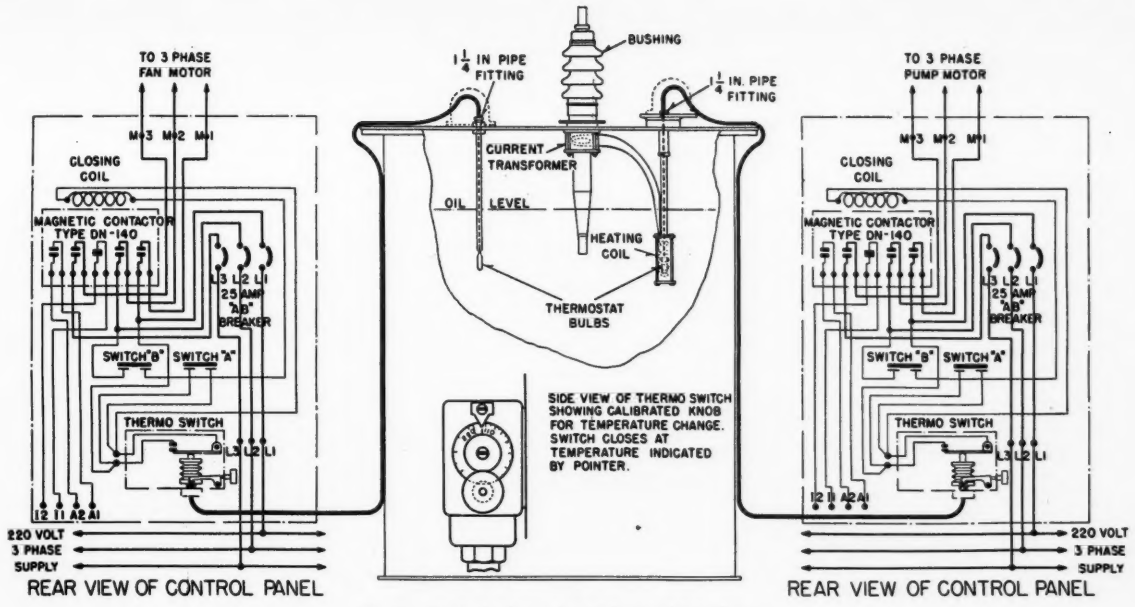

Fig. 2. Control scheme for triple-rated transformer

mounted on the side of the transformer tank.

Oil temperature changes at the bulb are transmitted as pressure changes to a metal bellows in the thermostat to make contact and close the motor circuit contactor. The fan motors are usually 220 v, 3 phase, 60 cycles. When the temperature of the oil drops to a predetermined value, the thermostat breaks contact, thus opening the motor contactor.

The closing contacts of the thermostat are adjustable within a range of 50 to 100 C by a calibrated knob on the thermostat. The setting of the thermostat for starting the fans is 60 to 70 deg hot oil temperature. To prevent frequent starting and stopping of the fans, a second adjustment of the thermostat is provided. This adjustment allows a variation from 3 to 25 C between the temperature that will close the starting contactor and the temperature at which it will open. The thermostat is usually set at 10 C differential at the factory.

In addition to the thermostat, a line start De-ion type contactor, a De ion type AB breaker, and auxiliary "flip-on" type switches are provided on the panel.

With the fans in operation, the transformer can deliver 12,000 kva. As the load increases beyond this point, the third cooling medium automatically comes into play. By means of winding temperature, the pump motor contactors are closed and the transformer then operates as a forced oil cooled unit, and will carry up to 15,000 kva capacity.

By speeding up the oil circulation through the ducts of the windings, the temperature difference between the copper and oil is reduced, enabling the transformer to carry the forced oil cooled rating with a hot spot temperature less than when operating at its self-cooled rating. The additional heat is brought to the outside more rapidly where it is dissipated from the radiators. The oil pumps, which with the motor are completely sealed in, are located in the headers between the transformer tank and the banks of the radiators.

The control for starting the pump motors is the same as is used for starting the fan motors. However, the bulb is inserted in a heating coil similar to that used with a hot spot temperature equipment. The secondary current from a current transformer passes through the heating coil and the bulb transmits the changes in winding temperature to thermostat No. 2. The normal setting of the thermostat for starting the pump motor is at 80 to 90 C, which is conservative, as the average winding temperature may be 95 deg (105 deg hot spot) with a 40 deg ambient temperature.

With this arrangement of automatic control, it is conceivable that on a sudden, heavy overload the pump motor might start before the fan motor contactors are closed. While this is not an undesirable feature, better protection is afforded if the fans are in operation whenever the pumps are running regardless of the oil temperature. (The oil temperature at the forced oil cooled rating will normally be lower than the oil temperature required to start the fans.) For this reason, contacts A and A_2 on the pump control panel are connected to energize the closing coil on the fan control panel.

When the load falls to a point where the winding temperature control stops the pumps, the fans will also stop for a short time—until the oil warms up to the temperature for starting the fans. Further reduction in load reduces the oil temperature and when the load drops below 9000 kva, the fans stop.

When this present emergency is over, the transformer can be operated as a 9000/12000 kva self-cooled forced air cooled transformer with automatic control for the blowers. This is common practice where the self-cooled rating matches the integrated load and where the forced air cooled rating could take care of short-time peak loads. This would mean economical operation, because the (extra) losses incident to forced cooled operation and the pump motor losses would not be present. At the same time, the forced oil cooled rating could be maintained for unexpected high peak loads.

A New Armature Winding Diagram

Part V

This installment of Mr. Taylor's discussion of the application of his new armature winding diagram is in the nature of an afterthought. It may be recalled that Part IV, which appeared in the August issue was designated as the final installment of the series. Part IV considered the layout of the unequa.ly grouped coil a-c type of winding. Since the publication of this part, the author felt that some readers might infer that he considered the unequally grouped windings referred to the only windings of that class and that it did not tell the story of the fractional slot and coil windings which are numerous in this country and abroad. The fractional slot and coil winding, however, is the same as the unequally-grouped-coil winding and to prove that his method will solve all the connected arrangements, Mr. Taylor now takes up the fractional slot and coil winding.

By WILLIAM T. TAYLOR

THE FRACTIONAL slot and coil winding is also an unequally-grouped-coil winding but it differs from the type discussed in Part IV in that it is both fractional-slot and fractional-coil; moreover, the type of winding discussed here is inherently fractional-pitch whereas the unequally-grouped-coil winding discussed in Part IV may be full-pitch or fractional-pitch as desired. A further distinguishing feature of the type of winding discussed herein is that the "chording" is fractional slot value and the adjacent bottom (B) and top (T) coil sides (whether short pitch or long pitch) pass through the same slot whereas every chorded winding discussed in Part III and IV usually has its bottom (B) and top (T) coil sides pass through the same slot at widely spaced positions in the magnetic field. Compare Fig. 2 of Part III with Fig. 2 of Part V and note the difference between top and bottom coil-sides in the same slot and same positions in the magnetic field.

Table I

(Top coil sides)		(Bottom coil sides)		(Top coil sides)		(Bottom coil sides)	
0°	to	60°	and	180°	to	240°	Phase A
60°	to	120°	and	240°	to	300°	Phase B
120°	to	180°	and	300°	to	360°	Phase C

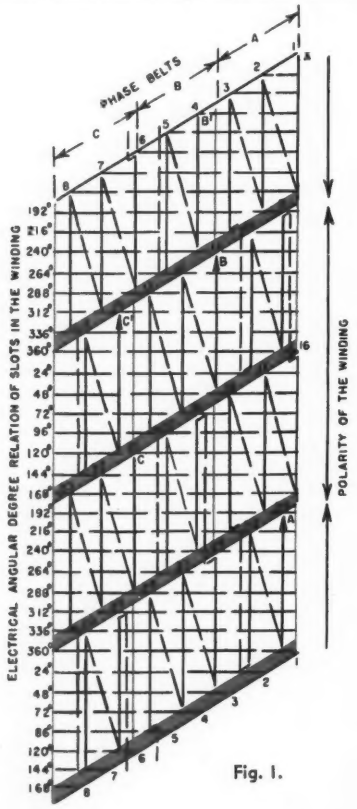

Fig. 1.

Examining the two distinct types of armature (2 layer) windings referred to, we see that the coil-pitch is changed from full to fractional, that the coils take up different positions in the phase zones, that the three phase-lead positions must now be chosen with special care in order to secure proper phase relations with regard to phase and neutral leads. The fractional slot and coil winding diagrams (Figs. 1, 2 and 3) visualize all these and other conditions. They show just where and how much a phase winding is overlapped, how the coils are grouped in the different phases and pole zones, and they visualize the real electrically identical coil-side positions and their electrical angular degree values. All this visualized information is extremely important to every operator of rotating electrical machinery.

In the integral slot and coil lap winding and the integral-slot fractional-pitch (or fractional-slot) lap windings there is usually a choice of two or more phase-lead positions, depending on the number of magnetic pole-pairs and number of phases in the winding. Not so however in the case of fractional slot and coil windings, due to cramped conditions creating fractional slot fractional-coil fractional-pitch layout.

Knowledge of the phase belts or phase-zone-boundary positions is no less important in the fractional slot and coil type of phase winding than the chorded windings of Part III and the unequally-grouped-coil windings of Part IV. In fact the reader would do well to commit them to memory so as to be certain about the correct coil grouping, phase-lead and neutral-lead positions, etc. And as a reminder the 3-phase conditions are again repeated.

The phase-zone boundaries remain fixed and definite. We saw in Part II how the basket and concentric types invaded phase zones, and in Part III we saw how the fractional-pitch windings invaded phase zones, now we see how phase zones are invaded in the fractional slot and coil windings —the manner of invading being different in each type of winding. Hence the reason why the engineer-operator should memorize the positions and the electrical angular degree values referred to above.

The basic winding elements of the 33-slot, the 30-slot and the 27-slot (fractional slot and coil) windings discussed herein are different to those of the equivalent unequally-grouped-coil windings discussed in Part IV; that is

30-Slot and Coil

Slot spacing .....24.00°
Coil throw .....1 and 8
or .....1 and 9
Coil span in deg.....168°
or.....192°

33-Slot and Coil

Slot spacing .....21.81°
Coil throw.....1 and 9
or.....1 and 10
Coil span in deg...174.54°
or...196.36°

27-Slot and Coil

Slot spacing .....26.66°
Coil throw.....1 and 7
or.....1 and 8
Coil span in deg...160°
or...186.62°

EXAMPLE A: Let us take a 30 slot core and place two coil-sides in each of the 30 slots (60 coil-sides in all), the coils to have the same span and be of the same shape, then so connect the coils in the phase groups as to produce a 30 slot and coil (2½ slot and coil) 4-pole 3-phase star-connected lap winding. Illustrate this winding by means of a diagram (Fig. 1) and extract therefrom the following:

(1) Fractional number of slots and coils per pole and per pole-phase group
(2) Fractional pitch of the coils throughout the winding
(3) Coil-side positions showing phase invasion, and which phases are overlapped
(4) Slot positions and electrical angular degrees of line and neutral phase-leads
(5) Order of coil grouping. Then, extract from Fig. 1 a
(6) Simplified winding table
(7) Fully developed winding table.

By other means let us first check the preliminary winding elements visualized in Fig. 1. The number of slots and coils per magnetic pole is $C/p = 30/4 = 7\frac{1}{2}$, and the number of slots and coils per pole phase group is $C/p = 30/4 \times 3 = 30/12 = 2\frac{1}{2}$. The coil throw may be 1 and 8 or it may be 1 and 9 as desired. Slots do not exist at the 180° full-pitch positions. The slot spacing is $180°p/C = 180° \times 4/30 = 720/30 = 24°$ per slot, or, $24 \times 7 = 168°$ short pitch, and $24 \times 8 = 186°$ long pitch. Accepting the short-pitched coil layout (168° coil span) the throw is $180° - 168° = 12°$ less than full pitch. Now check these results with Fig. 1.

Phase A starts as a top (T) coil-side in slot 1 and the chosen phase-lead positions are slot 1 (0°) pole 1 phase A, slot 11 (240°) pole 2 phase B and slot 21 (120°) pole 3 phase C — all of which are phase-boundary positions. Differing from the integral-slot winding it is seen that the neutral leads do not occur at the same phase boundaries as might be expected. Fig. 1 shows that the neutral phase leads have correct 120° relations, i.e., phase lead A′ is from slot 24 (192°), phase B′ is from slot 4 (72°), and phase lead C′ is from slot 14 (312°); thus $192° - 72° = 120°$, and $312° - 72° = 240°$.

Figure 1 shows that each phase is overlapped by two other phases; for instance, phase A is overlapped by the top coil-sides in slots 3 and 18 of phase B and the bottom coil-sides in slots 8 and 23 of phase C; phase B has overlapped currents from both phase A and phase C; also, phase C has overlapping currents from phases A and B.

In Fig. 1 the solid thick vertical lines such as those between slots 1 and 8, 2 and 9, represent the coils and coil throw; broken oblique lines between adjacent coils represent coil-to-coil connections; vertical broken lines represent group-to-group connections; solid lines slanting downwards from right to left represent the pole-zone boundaries; the thin red vertical lines represent phase-zone boundaries, and the oblique red portion along the pole-zone boundaries represent the fractional difference from full pitch.

Knowing the phase-zone boundaries referred to above, the order of coil grouping visualized in Fig. 1, is

3	2	3	2	3	2	3	2	3	2	3	2
A	B	*C*	A	*B*	C	*A*	B	*C*	A	*B*	C

The same phase-zone boundaries promptly identify the "simplified" winding-table positions; for instance, taken over one vertical line (per phase winding) Fig. 1 shows that they came nearest to the phase-lead zone boundaries. This is seen in Table II.

Extracting from Fig. 1, the electrically identical coil-side positions arranged in vertical order are

Phase A winding

(A)1 2 3 10 9
16 17 18 25 24(A′)

Phase B winding

(B)11 12 13 20 19
26 27 28 5 4 (B′)

Phase C winding

(C)21 22 23 30 29
6 7 8 15 14(C′)

For a 1 and 8 coil-throw the slot interval between electrically identical slot-positions is 15. To find the electrically identical coil-side positions of a winding, take cue from these diagrams which show the required positions to be at pole-pair intervals on the same (or nearest) vertical line. For this winding we have $1 + 15 = 16$, $3 + 15 = 18$, $12 + 15 = 27$, $15 + 15 = 30$, and so on for the entire winding.

Extracting from Fig. 1, the fully developed winding table is shown in Table III.

With the first coincident-slot position at $S/S\text{-}C = 36/36\text{-}30 = 36/6 = 6$-slot spacing, commencing from slot 1(0°), the equivalent integral-slot fractional-coil (36-slot 30-coil) winding table is shown in Table IV.

Table IV shows that the electrically identical top coil-sides are the same as those of the fractional slot and coil winding, but in this case the electrical angular degree values are different; in other words, the coil sides take up slightly different positions in the magnetic pole and phase zones. Thus, slot 24 of the fractional slot and coil winding occupies the angle 192° whereas slot 24 of the integral-slot fractional-coil winding occupies the angle 180°; slot 4 of the former type of winding occupies the angle 72° whereas slot 4 of the latter type of winding occupies the angle 60°; also,

Table II

Phase A	1(0°)	9(192°)	16(360°)	24(192°)	A′
Phase B	11(240°)	19(72°)	24(240°)	4(72°)	B′
Phase C	21(120°)	29(312°)	6(120°)	14(312°)	C′

Table III

	T	B	T	B	T	B	B	T	B	T	T	B	T	B	T	B	B	T	B	T	(Phases Overlapped)
A	1	8	2	9	3	10	17	10	16	9	16	23	17	24	18	25	2	25	1	24	A′ B and C
B	11	18	12	18	13	20	27	20	26	19	26	3	27	4	28	5	12	5	11	4	B′ A and C
C	21	28	22	29	23	30	7	30	6	29	6	13	7	14	8	15	22	15	21	14	C′ A and B

Leads A′-B′-C′ are joined together to complete the 3-phase star-connected winding.

Table IV

	T	B	T	B	T	B	B	T	B	T	T	B	T	B	T	B	B	T	B	T		No phase overlap
A	1	9	2	10	3	x	17	10	16	9	16	24	17	25	18	x	2	25	1	24	A′	
	0°																		180°			
B	11	19	12	20	13	y	27	20	26	19	26	4	27	5	28	y	12	5	11	4	B′	
	240°																		60°			
C	21	29	22	30	23	z	7	30	6	29	6	14	7	15	8	z	22	15	21	14	C′	
	120°																		300°			

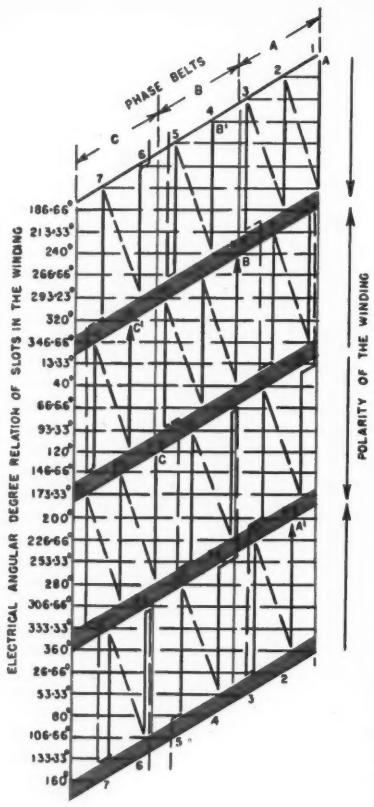

Fig. 2

slot 14 of the former type occupies the angle 312° whereas slot 14 of the latter type occupies the angle 300°. Careful examination of Fig. 1 also shows that all the 120° phase relations are satisfied.

Now consider a ¼ slot-step condition such as a 27-slot and coil winding—the above example having reference to a ½ slot-step winding.

EXAMPLE B: Assume a 27-slot. stator core in which are placed 27-coils (54-coil sides) so connected as to produce a 27-slot and coil (2¼ slot and coil) 4-pole 3-phase star-connected lap winding. Fig. 2 shows such a winding layout in full detail, minus the star connections which are external to the winding proper.

Number of slots and coils per magnetic pole is $C/p = 27/4 = 6\frac{3}{4}$; number of slots and coils per pole phase group is $C/p\emptyset = 27/4 \times 3 = 27/12 = 2\frac{1}{4}$. Coil throw may be 1 and 7 or it may be 1 and 8 as required. No slots exist at the 180° full pitch positions. The short pitched (160°) throw is decided upon. The degree shortening is 180° — 160° = 20°, therefore 26.66° — 20° = 6.66° less than a one slot-spacing which is impossible in an integral slot and coil winding.

Table V

Phase A	1(0°)	8(186.66°)	15(13.33°)	22(200°)	A′
Phase B	10(240°)	17(66.66°)	24(253.33°)	4(80°)	B′
Phase C	19(120°)	26(306.66°)	6(133.33°)	13(320°)	C′

Table VI

	T	B	T	B	T	B	B	T	B	T	T	B	T	B	B	T	B	T		Phases Overlapped
A	1	7	2	8	3	9	15	9	14	8	15	21	16	22	2	23	1	22	A′	B and C
B	10	16	11	17	12	18	24	18	23	17	24	3	25	4	11	5	10	4	B′	C and A
C	19	25	20	26	21	27	6	27	5	26	6	12	7	13	20	14	19	13	C′	A and B

Table VII

	T	B	T	B	T	B	B	T	B	T	T	B	T	B	B	T	B	T		
A	1	8	2	9	3	x	x	9	15	8	15	x	16	23	3	23	2	22	A′	No
B	10	17	11	18	12	y	y	18	24	17	24	y	25	5	12	5	11	4	B′	overlapped
C	19	26	20	27	21	z	z	27	6	26	6	z	7	14	21	14	20	13	C′	phases

Figure 2 shows that the three phase-lead positions have the same electrical angular degree relations as the 30-slot and coil winding, i.e., Slot 1(0°) for phase A, slot 10(240°) for phase B, and slot 19(120°) for phase C. However, the electrical angular degree relations of the three (neutral) phase-lead positions are not the same as Fig. 1 though the 120° values are maintained. Phase lead A′ is from the top coil-side in slot 22(200°), phase lead B′ is from the top coil-side in slot 4(80°), and phase lead C′ is from the top coil-side in slot 13(320°), thus making the angular degree relations equal to 320° — 80° = 240°, and 200° — 80° = 120°, which are satisfactory.

Starting at the upper right side of Fig. 2 and reading from right to left per magnetic pole zone, the order of coil grouping reads

3 2 2 2 3 2 2 2 3 2 2 2
A B C A *B* C A B *C* A B C

Figure 2 also provides the "simplified" winding table in Table V.

And the fully developed winding table, extracted from Fig. 2, is shown in Table VI.

As before, the three (neutral) phase leads A′-B′-C′ are joined together to complete the star connection.

The equivalent 36-slot 27-coil winding layout gives the fully developed winding data in Table VII.

Again proving that the *top* coil-sides are situated at electrically-identical slot positions in both cases; in other words, both winding tables give the following results for top coil-sides:

Phase A 1 2 3 9 8 15 16 23 22 A′
Phase B 10 11 12 18 17 24 25 5 4 B′
Phase C 19 20 21 27 26 6 7 14 13 C′

We may ask, why go to the trouble of making a fractional slot and coil winding diagram when the simpler integral-slot diagram, shown in Parts I to IV inclusive, can give the results required? The answer to this question is that ample diagrammatic proof is needed to show the wide versatility and practical utility of this form of armature winding diagram, and that a diagram of each class or type of winding is better able to give the real electrical angular degree values of every coil side in the winding as well as the true phase and neutral-lead electrical angular degree positions and relations.

For a 1 and 7 coil throw the slot interval between electrically identical coil-side positions is 14. And taking the cue from these diagrams for similar pole-pair phase-pitch coil-side positions, we read 1 + 14 = 15, 10 + 14 = 24, 13 + 14 = 27, and so on.

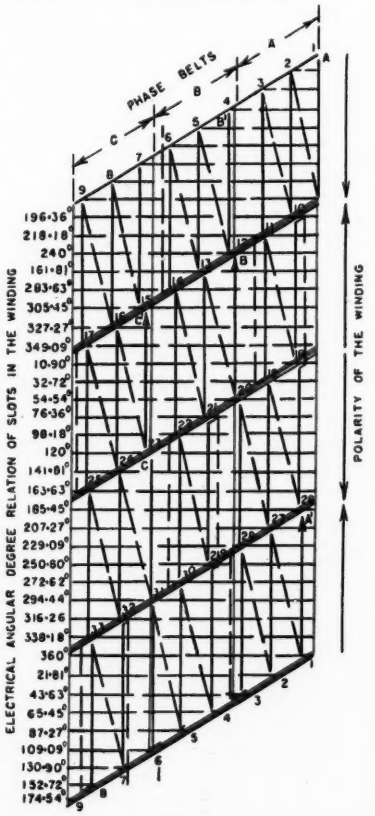

Fig. 3

Table VIII

Phase A	1(0°)	10(196.36°)	18(10.90°)	26(185.45°)	A′
Phase B	12(240°)	21(76.36°)	29(250.90°)	4(65.45°)	B′
Phase C	23(120°)	32(316.36°)	7(130.90°)	15(305.45°)	C′

Table IX

| | | | |

Superheater Response to Fuel Conversion

By E. R. KILSBY
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Among the problems confronting the power engineer when he changes from one type of fuel to another for the generation of superheated steam is the effect this change will have upon the superheater operation and its maintenance. In this article, the author discusses how steam temperatures are affected by the changes which have been made necessary in many plants that have been required to convert from gas or oil to solid fuels. Efficiency, slag formation, drainage, localized overheating and other operating problems of the various types of superheaters are given consideration by the author

WARTIME restrictions have necessitated the conversion of many steam generating plants from liquid, or gaseous, fuel to coal or other solid fuel. The results of such conversions on boiler performance are ordinarily matters of altered efficiency or capacity due to changed weights and temperatures of combustion gases. Ash and slag formations may also require some attention but damage to boiler, economizer or air heater as a direct consequence of the fuel change is seldom encountered.

Superheaters, however, will need special consideration, especially where large superheaters for high temperatures, or radiant type superheaters, are involved. In general, it has been found that in the case of a steam generating unit, not having automatic superheat control, which is changed over from gas to coal firing, there will probably be a progressive increase in steam temperatures leaving the boiler. Occasionally the increase may be as high as 70 F at a given steam output, after the first few months of coal fired operation. This will be true even though feedwater temperatures, CO_2 and other conditions appear unchanged. The amount of increase depends upon many factors.

The temperature increase is the result of a residual ash or slag coating that develops on the water heating surface and the collection of ash in the baffle pockets. The heating surfaces have, therefore, become partially insulated. This condition is more pronounced on the surfaces closest to the point of fuel burning. The reduced absorption of heat by these surfaces causes the superheating surfaces to be exposed to higher temperatures. Yet there is often no apparent increase in the boiler exit gas temperature since the greater heat absorption by the superheater and rear parts of the boiler offsets the reduction in absorption by those surfaces nearest the furnace.

In some instances, after conversion, there will be a marked change in the degree of superheat at a given rating without any change in the residual coating of the water heating surface. These changes depend upon: (1) the relative efficiency of the fuel firing equipment, (2) possible changes in the boiler unit efficiency, and (3) the relative weight of combustion products for a given steam output. For example: Assuming good gas or oil burning equipment and stoker firing of coal (pulverized fuel equipment being of limited availability) it is ordinarily possible to burn natural gas with not more than 15 per cent excess air. Bunker "C" oil, in many cases, can also be burned with 15 per cent excess air. But stoker firing of coal even though of high grade, must usually accept 20 per cent excess air as good performance.

For a given unit efficiency there would be about 6 per cent more combustion gas with coal than with oil, and slightly more than 10 per cent greater quantity than with gas fuel. But unit efficiency in most cases is least when burning gas and the relative quantity of combustion products would more nearly equal that of oil for the same boiler output. With stoker firing the unit efficiency will be perhaps 1 per cent lower than when oil is burned and the combustion gas weight is therefore higher. There are many possible variations of these relationships, particularly where units are not well adapted to the use of the solid fuel.

Unless designed for higher

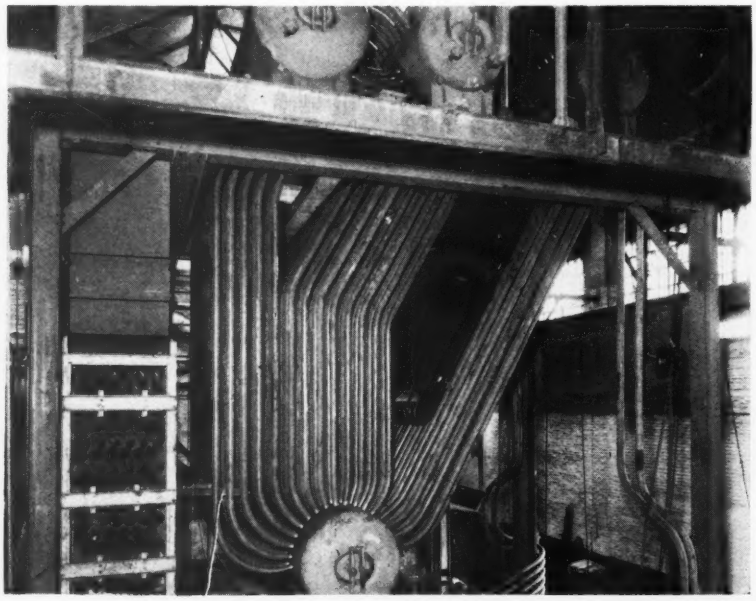

Fig. 1. Construction view of convection type superheater with pendant superheater elements

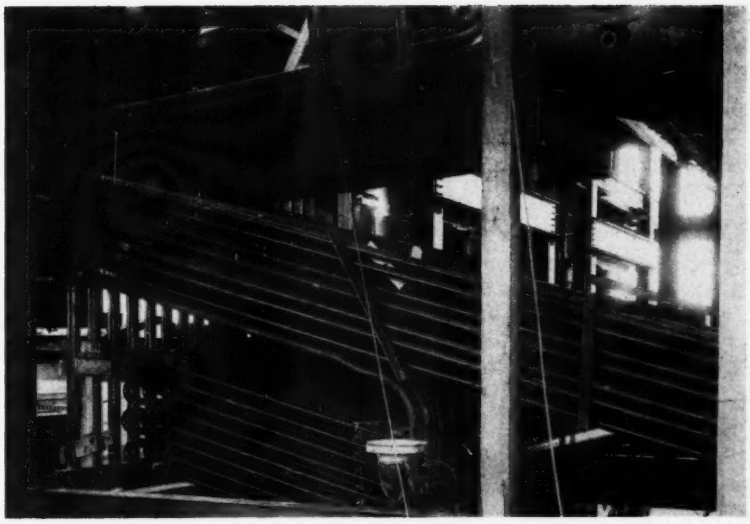

Fig. 3. Convection type superheater, interdeck design, under construction

steam temperatures, superheaters built of carbon steel tubing are likely to be damaged when outlet steam temperatures exceed 750 F. Superheater tube or "element" metal temperature in the zone of heat absorption is commonly from 50 to 125 F greater than the steam temperature obtained. In some cases this temperature difference may vary either above or below these figures.

It is evident that if steam temperatures increase superheater surface temperatures must rise also. Ordinary "carbon steel" boiler tubing is used in the majority of superheaters for final steam temperatures up to 750 F. In a few instances, such tubing is used for slightly higher temperatures. In such cases, the design of the superheater permits only a minimum temperature difference between steam and steel under normal operation.

It may generally be assumed that the allowable steam temperature from a superheater built of alloy tubing (i.e. "carbon ½ per cent moly," "4-6 per cent chrome" etc.) should not exceed the maximum normal for which it was built by more than 5 per cent.

Superheaters are most likely to be damaged by overheating during initial firing of a unit when steam flow through them is lowest. A change of fuel and firing equipment may increase this hazard. "Banked fires" provide much the same condition though this may not be realized by operators of plants previously burning liquid or gaseous fuels.

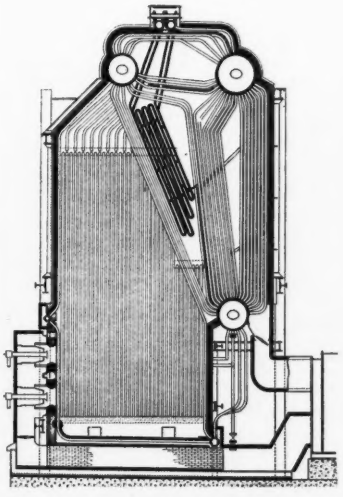

Fig. 2. Cross-section through boiler, showing relative location and proportion of a convection type superheater

Convection Superheaters

Where convection type superheaters only are installed, possible slag formations would blanket or isolate parts of the superheating surface and cause a concentrated flow of gas over another section of the superheater. This condition increases the heat transfer rate in the unblanketed section of the superheater and localized overheating of tubes may occur. Secondary combustion in the superheater zone often develops where slag coatings exist in the tube bank.

Where elements are blanketed or shielded by slag coatings, the normally complete evaporation of condensate in superheater tubes is often prevented. Retention of water in some elements of the larger, non-drainable type superheaters thus causes the small quantity of low pressure steam being bled from the superheater outlet drain, during initial firing, to flow through the water-free elements only. Those portions of water-holding elements not slag shielded are then subjected to hot gas flow without the protection against localized overheating, normally provided by the bled steam. In view of the relatively small steam flow at such times, the pressure difference between superheater inlet and outlet headers is often too little to blow out the water trapped in the bottom ends of pendant superheater elements.

Radiant Type Superheaters

Radiant type superheaters are most apt to show altered performance because of (1) higher or lower percentages of CO_2, (2) furnace slag deposits, and (3) change of proximity of active flame.

In some cases, there will be a flow of flame or gas directly on or over the radiant superheater surface whereas formerly there was not any, and vice versa. Some form of refractory shielding or coating of radiant surface can then be provided to reduce heat transfer. This refractory, however, should be applied so that the transfer of heat is substantially uniform, i.e., protect all of that portion of the superheater surface where heat transfer is the greatest. Do not shield some elements completely and allow others or parts of elements to be subjected to such intense heat that these areas will provide substantially

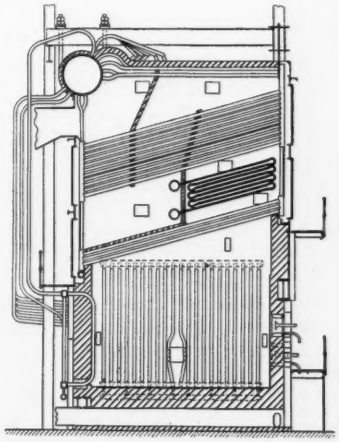

Fig. 4. Tube arrangement of a steam generating unit employing the interdeck location for a convection superheater

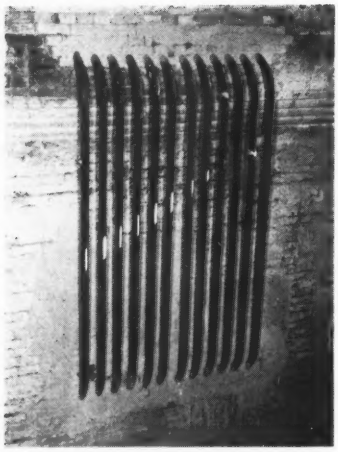

Fig. 5. Tubes of a radiant type superheater are of necessity located where changes in fuel are apt to alter performance of the unit

all of the desired superheat. In other words, avoid localized "hot spots".

Combination Radiant and Convection Superheaters

Combination radiant and convection superheaters involve the problems of both the 100 per cent convection and 100 per cent radiant superheaters. The operator, however, has the advantage of being able to vary the percentage of total superheat being delivered by either the radiant or convection section. Increased CO_2 results in higher radiant transfer, lower convection transfer, and vice versa. Frequently altered adjustment of fuel firing equipment will reduce "radiant" absorption without a resultant change of CO_2.

Separately Fired Superheaters

Separately fired superheaters usually have much the same characteristics as large combination radiant and convection superheaters but the "radiant" portion is relatively small. The problems are apt to be those of both the strictly radiant superheaters and all convection superheaters, with the emphasis on the latter type during normal operation and the former during light loads or "banked fires".

In addition there is often a special condition resulting from the intermittent or irregular need for superheated steam.

Often automatic by-passes to divert gas from the convection surface during periods of "no flow" can be contrived and an adequate bleed of steam from the superheater outlet to some constant user or piece of apparatus capable of absorbing the necessary flow without too much waste can be provided to prevent the radiant surface becoming overheated.

Sometimes an arrangement whereby cooling air is admitted over the top of the fuel bed, with firing stopped automatically, can be used advantageously. Where this is done, the combustion air supply must be stopped even though the unit exit gas damper is open enough to insure adequate flow of cooling or diluting air through the unit.

Where conversion from liquid or gaseous to solid fuel is under consideration, the following suggestions are offered:

1. Greatest flexibility of arrangement or equipment should be a deciding factor when alternates are available.
2. Operators of installations having final steam temperature recorders should plan close observation of temperatures for a period of several months.
3. Where steam temperature recorders are not installed or are installed in such a manner that the superheater outlet temperature is not recorded until the superheater outlet valve is opened, it may be advisable to install a second valve in the superheater outlet drain line.

When the unit is being put into operation, both valves in the outlet drain line will be fully open, as usual during such periods. The temperature of the steam should be taken each one-half hour during this period, using a thermometer in the well provided in the superheater outlet header.

When the unit is on the line the steam temperature would be recorded each half-hour if near the upper safe limit, otherwise every two hours. When the unit is taken out of service, the temperature would be recorded each half-hour until several readings show a continued and pronounced decline.

Where steam flow or firing, or both, change rapidly or considerably, a temperature recorder is most advantageous. Otherwise close observation must be maintained until it is certain that there is no overheating under any probable load or firing conditions.

If it is found that flow reduces to a point where temperature increase becomes too great, the first valve in the superheater drain may be opened fully and the second valve opened sufficiently to provide minimum steam flow necessary to prevent overheating. The wear due to "wire drawing" is thus taken by the second valve while the first provides means for tight shutoff when no steam bleed is required or desired.

4. Convection superheat may usually be reduced by partially blanketing or shielding the heating surface by covering with refractory. A little study of the superheater installation will indicate the probable path of the combustion gases through the superheater. Diversion of the gas from this path to another in which it crosses or bathes less superheater surface is usually possible.

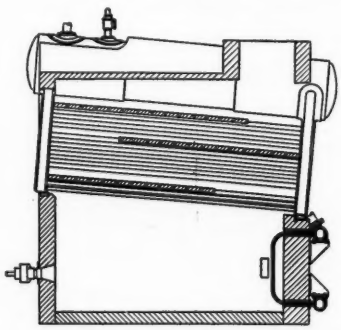

Fig. 6. A common location for a radiant type superheater

Care should be exercised not to so reduce the area for exit of the gases from the furnace that a "bottled-up furnace" results. Diversion of flow—not restriction—is needed.

5. Where combination radiant and convection superheaters are installed with the steam first passing through the convection section, a reduction of the increased steam temperature (in the convection section) by either diversion of the gas or by the isolation of superheating surface will prevent high or excessive temperature from the radiant section. But it should be remembered that an excessive transfer rate in the radiant superheater may be hazardous, if concentrated.

Overfire Air Performance Applied to Stationary Plants*

By H. C. CARROLL
Mechanical Engineer
Commercial Testing & Engrg. Co.

Seldom in the history of smoke prevention agencies has a greater challenge arisen than in the present emergency when thousands of oil burning plants, quite free from smoke emission, are being converted to solid fuels, quite vulnerable to smoke emission. Furthermore, the restrictions even now placed on obtaining the kinds of solid fuels that would be most helpful in reducing the tendency to smoke are becoming more restricted. Application of overfire air is helping to solve the smoke problem through arrangements described in this paper

IT IS not always possible to meet the usual smoke prevention requirements in conversions from one fuel to another, and expedients have to be resorted to. One of these is the proper application of overfire air to the furnace. The simplest method is the introduction of the air by steam jets, if the plant is operated at sufficient steam pressure for their use. Compressed air can be used also if available, but this usually is considered too costly. Power driven fan blowers are used very efficiently in the larger installations.

While these expedients primarily may be applied to eliminate smoke and fly ash, if properly applied they can produce higher heat releases in a given furnace volume, increase steam or heat production of the unit, reduce slagging, improve ignition, and effect better efficiencies.

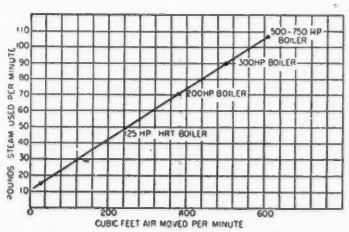

Fig. 1. Curve of steam jet steam consumption

Overfire air provides turbulence to mix thoroughly the rich and lean gases, prevents stratification in furnaces, and reduces the combustible matter in fly ash when coal is burned in suspension.

In the application of steam jets, the purpose should be to use the least steam to convey the most air at sufficient velocities to provide proper turbulence to produce the desired results. Just a steam pipe nipple drawn down at the end and inserted in a larger pipe to convey the air to the furnace is a method often seen; but this is wasteful as the jet soon increases in size, due to wire drawing, and greater waste of steam is occasioned. While this may eliminate the smoke nuisance, it is a poor emergency job.

The jets should be made of a material that has long life even with wet steam, and should be designed to convert pressure head into velocity head at the highest efficiency. The jets should be carefully designed and laid out as to number and direction to fit the particular furnace to which they are applied, so that they will not supply an excess of overfire air.

Many designs of hand fired heating furnaces have been made in an endeavor to furnish the overfire air when fresh high volatile coal is used, but most of them still depend on the human element in their operation.

On the larger hand fired jobs where steam is generated at a pressure, steam jets have been successfully used to reduce the period of smoke emission to comply with existing ordinances. These units are hardly large enough to warrant the necessary expenditure for forced overfire air application, but some such applications have been made with success.

In this type of plant it is estimated that the steam used by steam jets would be as high as 2 per cent of the steam generated to successfully eliminate smoke. This figure is based on horizontal return tubular boiler settings where steam jets are used periodically after firing, while the volatile matter was being driven off, and depending on hand control for cutting off jets between firing periods. To offset this use of steam for jets, the boiler surfaces were maintained cleaner due to the absence of soot deposits, burning of the hydrocarbons, and lower stack losses. Some of this loss was recovered.

Single Retort Underfeed

In single retort underfeed stokers, use can be made of the forced blast air in supplying the

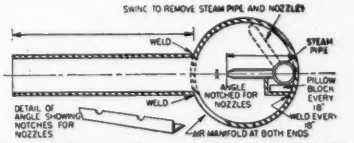

Fig. 2. Removable manifold nozzles of this steam air jet are easily replaced when they become worn

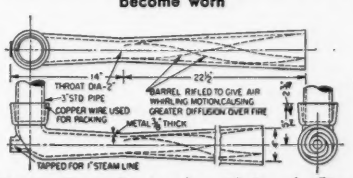

Fig. 3. Streamline nozzles with barrel rifling are effective in diffusing air

*Abstract of paper presented at Smoke Prevention Meeting at Pittsburgh, Penna., June 10, 1943.

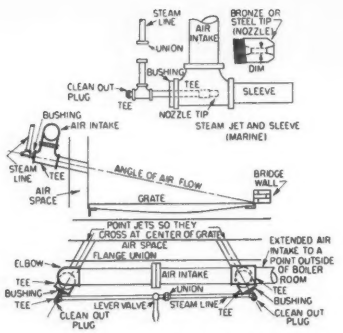

Fig. 4. Cross jets in front of hand fired furnace are effective in creating turbulence

overfire air. In this method of firing and application of overfire air where there already is some agitation of fuel bed and fair air distribution, it is necessary only to see that sufficient overfire air is supplied at the proper place to accomplish the results desired. In some instances this is applied in front walls and through the bridgewall, while in others it is applied in the side walls only.

It is not necessary to make these of formed jets, although this can be accomplished if necessary by the use of precast jet blocks, either of firebrick, or better of air-cooled carborundum blocks, which have long life. At the higher combustion rates the air pressure automatically increases, and the nozzles should be designed to supply sufficient air to prevent smoke emission at maximum demands, and to insert dampers in the supply ducts for decreasing the amount of air at the lower ratings.

Chain Grate Stoker

In chain grate stokers there is not so much tendency to smoke except at loads which call for the grate to be fully covered with fuel, or when the draft is reduced, especially where automatic control is employed.

More difficulty is experienced with smoke on the natural draft chain grate stoker than on the forced draft stoker where zoned control exists. On natural draft chain grate stokers there is usually an ignition arch immediately over the gate where the coal enters the furnace. Above this there is a combustion arch intended to provide radiant heat to the fuel bed, as well as to conduct the volatile gases being thrown off at the gate toward the rear of the furnace, where they will meet the lean gases from the rear of the grate and water back, and cause a combustible mixture free from smoke. Cross steam jets used at the rear, as well as at the front, provide a good means of causing turbulence and hasten the mixture of these gases. Often a series of jets supplies overfire air through openings in the arch.

There is a trend today to shorten the combustion arches, both in natural draft and on forced draft chain grate stokers. Opening up the furnace by cutting down the length of this arch, exposes more of the boiler water surface to radiant heat, cuts down brickwork maintenance, and increases the boiler rating. When this is done the application of overfire air is essential to prevent smoke and insure ignition, and calls for careful design and layout.

In the larger furnaces air pressures (not steam jets) as high as 20 in. of water column sometimes are necessary. The nozzles are made of high temperature resisting metal, with venturi throats. To maintain turbulence at partial ratings, the plenum box often is divided, every other nozzle entering in one half of the box, and the remainder in the other half. By cutoff dampers, half of the air can be shut off and still obtain penetration and turbulence with the other half of the nozzles in operation, with half the air injected.

Overthrow Stokers

Overfire air is most essential with overthrow stokers, not only for smokeless combustion but also to materially reduce fly ash emission and cut down combustible lost in the fly ash. In some designs of this type of firing, air ports are provided in the front wall for admission of air supplied from the windbox, and are part of the design. Most frequently steam jets, or fan driven forced air, provide the overfire air through the bridgewall, and at the same time reinject the fly ash collected in the rear passes of the boiler or dust collectors. A high pressure fan, instead of steam jets, can also be used for this purpose, care being taken to limit the amount of air so used as not to increase excess air in the furnace beyond economical limits.

We have employed flue gas in furnaces for the purpose of turbulence, instead of air, where the furnace lacks turbulence, but has sufficient excess air. Usually steam jets are employed in this case to handle the hot flue gases.

Multiple Retort Underfeed Stokers

Overfire air has been found useful on this type of firing, not

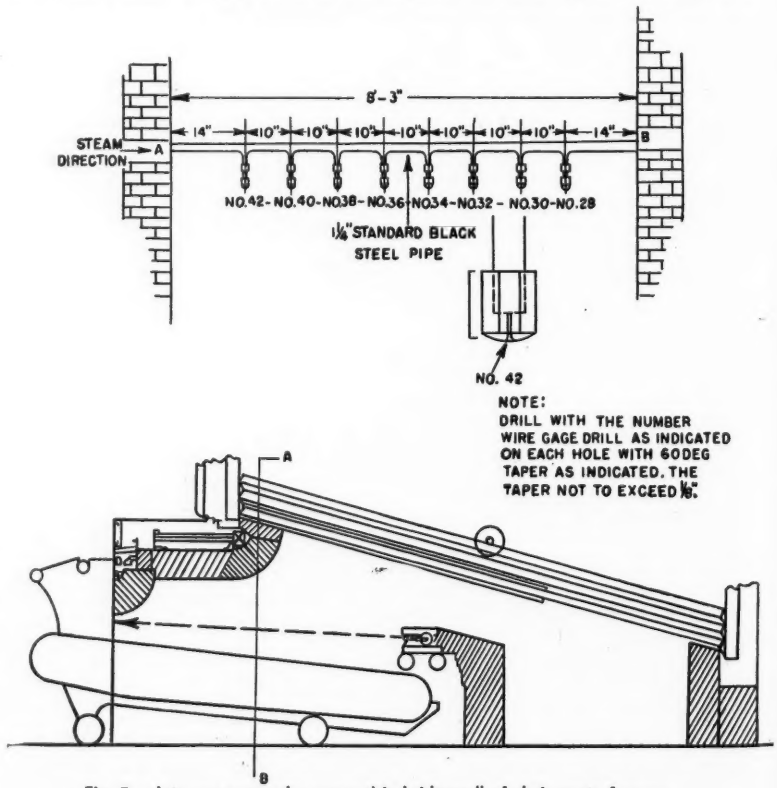

Fig. 5. Jets are commonly arranged in bridgewall of chain grate furnace

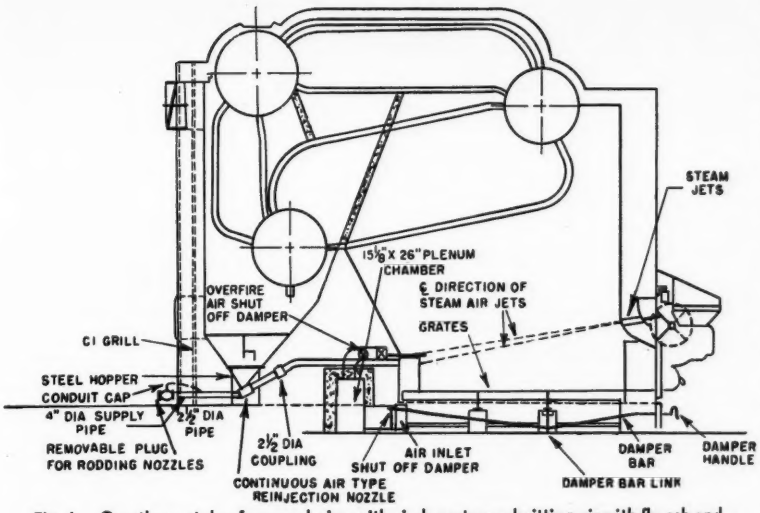

Fig. 6. Overthrow stoker furnace design with cinder return admitting air with fly ash and provided with front steam jets

so much perhaps to eliminate smoke as to provide turbulence and prevent stratification of the gases in the large open furnaces above the fuel bed. Some coals of the midwest, which are high in volatile gases (up to 45 per cent), give plenty of smoke on these furnaces, especially on a varying load, under automatic combustion control.

The fuel bed on multiple retort furnaces is normally quite thick, and if the drafts are closed for a fluctuating load, as is the practice in many plants, the furnaces will smoke. Here, due to wide and deep furnaces, high pressure air supplied by individually driven fans is employed to provide proper penetration of air. We have employed as high as 30 in. of water pressure where furnaces were 20 ft wide and as deep.

Also, we have found that if hot air can be employed where a preheater is installed, better results are obtained. Application is employed through carefully designed and laid out nozzles, sometimes in the front wall, often in the rear walls, and not infrequently in the side walls. The location, velocity at nozzle, volume of air, and direction of jets are worked out to meet the particular design of furnace and coal used.

Scotch Marine Boilers

A great number of Scotch marine boilers on heating loads are being converted from oil to coal. Many are of the one tube type but there are also some large enough for two Morrison tubes in them.

With oil it is usual to fire directly into the tubes and do a fair job of combustion, often using a little brick work around the burner.

To apply coal to this type of boiler, we are adopting a Dutch oven out in front with a water cooled roof on it which is tied into the circulation. This can be done even if the boiler operates on a low pressure. Either a single retort underfeed or a hand fired grate is used. Ratings up to a maximum of 125 per cent of normal rating are allowed. With oil, 200 per cent is quite common.

There have been stokers installed inside the tubes on this type of boiler but the difficulties encountered are many and ratings carried are low and high fusion coals are demanded.

In General

One of the uses of overfire air, which has not been emphasized, is to employ it in furnaces using high volatile coals, which, in some types of furnaces, cause long flame travel often extending through the first bank of tubes, and often through the superheater tubes, causing impingement of flame action. The flame travel can be shortened to the desired point so that the flame will tail out by the time it reaches the first entrance of the boiler pass, by proper application of overfire air. This decreases flue gas entrance temperatures, decreases slag formation, and superheater tube deterioration.

While this flame travel may only occur at the higher ratings, with overfire air jets in use temperatures measured by means of water cooled sampling elements at the entrance of the first gas passages often reveal a reduction of temperature and shortening of flame enough to be below fusion temperature of the fly ash and prevent fly ash adhesion to tubes. The flame entirely disappeared from the superheater section.

Water-Distributing Systems for Buildings

A COMMON and exasperating experience in the average home is the complete or nearly complete failure of the water supply on the upper floor caused by the simultaneous use of several fixtures on the lower floor, thus overloading the water-distributing system in the building. The difficulty is due to the fact that the sizes of the building supply main and of the branches for a small dwelling are rarely designed but are selected by a hit-or-miss process.

Even if the pipe sizes are chosen to give an adequate supply of water when the system is new, the supply may become inadequate in the course of time because of the deterioration of the inner surface of the pipes due to corrosion or caking by the water that flows in them. This deterioration leads to increased resistance, resulting in a decrease in the rate of flow that can be obtained at any given fixture.

Different water supplies vary markedly in their caking and corroding effects on pipes. In some parts of the United States, hot-water pipes of the most commonly used material must be renewed annually on the average, whereas in other localities the same kind of pipe may give good service for 20 years or more. Under most conditions, satisfactory service can be assured over a reasonable period of years by using pipes of suitable material and by selecting large enough pipe diameters for the various parts of the system.

Building Materials and Structures Report BMS79, recently released, is intended to make available for practical use a method of procedure for sizing the pipes properly in designing building water-distributing systems. It also gives information that will aid in choosing proper materials for use in the piping system, a subject on which little has been published in usable form.

Copies of BMS79 are obtainable at 15 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Hydraulic Turbine Pitted Surfaces Repaired by Electric Welding*

By E. F. BLADHOLM

Mechanical Engineer Associate
Department of Water and Power,
City of Los Angeles, Calif.

Francis type hydraulic turbine installed in Boulder power plant after two years of operation showed evidence of pitting. To prevent further destruction, the surfaces were chipped and milled down to unharmed metal and given welded-on surface which not only gives protection against pitting but has improved operating efficiency of the units. This article gives the details of the procedure, the metals used, the equipment employed, and distribution of labor

MAINTENANCE problems on the power system of the Department of Water and Power, City of Los Angeles, are probably the largest of their kind. The total connected generating capacity is approximately 800,000 kw, of which 495,999 kw are represented by six 82,500-kva hydroelectric generators at Boulder Power Plant. The first of these units was placed in operation October, 1936.

Maintenance of the hydraulic turbine runners on these units was started in 1938. The work was done by the General Plant Division shops, and to date a total of 31,566 sq in. of pitted surface, due to cavitation, has been repaired. During this month approximately 3460 lb of welding rod have been used, of which 2735 lb was mild steel, 650 lb was 18-8 stainless, and 75 lb was 4-6 chromium. A total of 12,577 man hours was required for completion of repairs. A high standard of continuity service has been maintained with a minimum of outage in line with the policy of the Operating Division.

The hydraulic turbine runners described in this paper are of the Francis type, developing 115,000 brake horsepower at approximately 2500 cu ft per second at 500 ft head. The runners are of immense proportions, being approximately 15½ ft in diameter and weighing approximately 75,000 lb.

They are of cast steel construction, having approximately the following percentages of alloying elements: Carbon 0.32, Silica 0.35, Manganese, 0.70, Sulphur 0.025 and Phosphor 0.025.

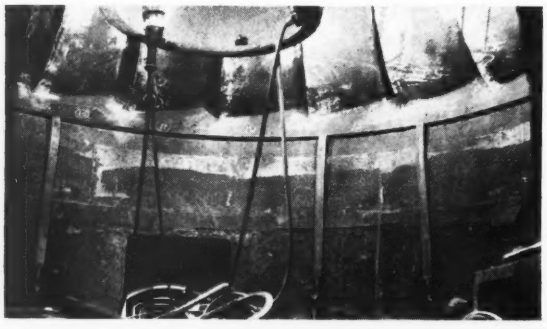

Fig. 1. (Left) Underside of hydraulic turbine runner seen from draft tube

Fig. 2. (Below) Deteriorated turbine runner

The inside diameter of the runners at the top of the draft tube is 11 ft, allowing ample space for working. There are 19 vanes which from the draft-tube side are approximately 39 in. high and 1 in. thick at the trailing edge. Figure 1 shows a view of the under side of the runner from the draft-tube side.

At the low heads, considerable noise was experienced in turbine operation, and as a result vane struts were installed by the manufacturer. Some varied success was experienced, but a few months later the struts were removed.

Pitting Advanced Rapidly

In February, 1938 approximately 16 months after Unit N-2 was placed in service, inspection showed that the pitting had advanced seriously. In fact, cavitation was propagating so fast, it was necessary to plan an extensive repair program for the low peak season which was only a short time away. The extent of cavitation on the other units N-1, N-3 and N-4 was similar to that found in Unit N-2, but varied in degree of intensity. The general picture of the deteriorating effect is shown on Fig. 2. In some places the vanes which were approximately 1 in. in thickness at the trailing edge were cavitated clear through the metal. It was felt that, at the increased rate of cavitation shown by inspection, the units would not operate through the next winter peak season without serious damage.

With only a short time available for preparation, the General Plant Division's Engineering and Shop Sections cooperated in laying out equipment, materials, and methods for handling the job. Available information of the meth-

(*Continued on Page* 110)

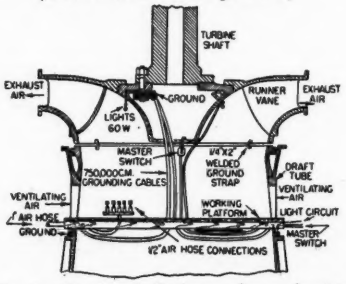

Fig. 3. Staging built for workmen showing conveniences

*Data and illustrations from a paper submitted to the James F. Lincoln Arc Welding Foundation by the author in a $200,000 Industrial Progress Award Program.

The PRACTICAL ENGINEER and ELECTRICIAN

ANDREW W. KRAMER, EDITOR

ODE TO THE FIREMAN*

My CO_2, she's verra bad,
And me, Senor, am verra sad.
For one whole hour, I watch with eyes,
But damn CO_2, she no will rise.

I think I screw the damper down,
But CO_2 go up and down.
I try to push reflector in,
By Gar, Senor, "She's Crazy Then"!

I ask you, Senor, "What I do?"
Boss man say, "Get good CO_2".
Da gas, she burn, Da steam, she flow,
I no know why she get so low.

Last time I look, she was on six,
By Gar, Senor, She in awful fix.
I think I try it, jus' once more,
Sacre Mon Dieu, "She Go To FOUR".

I GO NOW,

(You have a hole in your calcium chloride)

*From the boys at
Camp Joseph T. Robinson, Arkansas

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A Section of Power Plant Engineering Devoted to
PLANT OPERATION AND MAINTENANCE

Technical Publishing Company
53 West Jackson Blvd., Chicago 4, Ill.

An Operating Engineer's Criticism of Refrigeration System Design

Many operating engineers know their "stuff". They know the details and the characteristics of the equipment in their plants and know how to keep it running even under adverse conditions. Few engineers are articulate enough, however, to tell others about these things—things which would help younger and more inexperienced engineers to understand why things do not always work the way they are supposed to. Mr. Holman is an exception; he has a remarkably well-developed analytical mind and he always seems to be able to put his ideas and thought "across" in a way that any engineer can appreciate This article on refrigeration systems is an excellent example of Mr. Holman's insight into operating problems, one, which we feel certain will be of interest

By GEORGE HOLMAN

THERE ARE in this imperfect world peculiar arrangements of pipes, valves, pressure vessels, a machine or two and other gadgets, the wholes of which are known as refrigerators or refrigeration systems. Although their designers may not believe it, these systems are as imperfect as the men who design, service and operate them. However, such imperfections as they usually have do

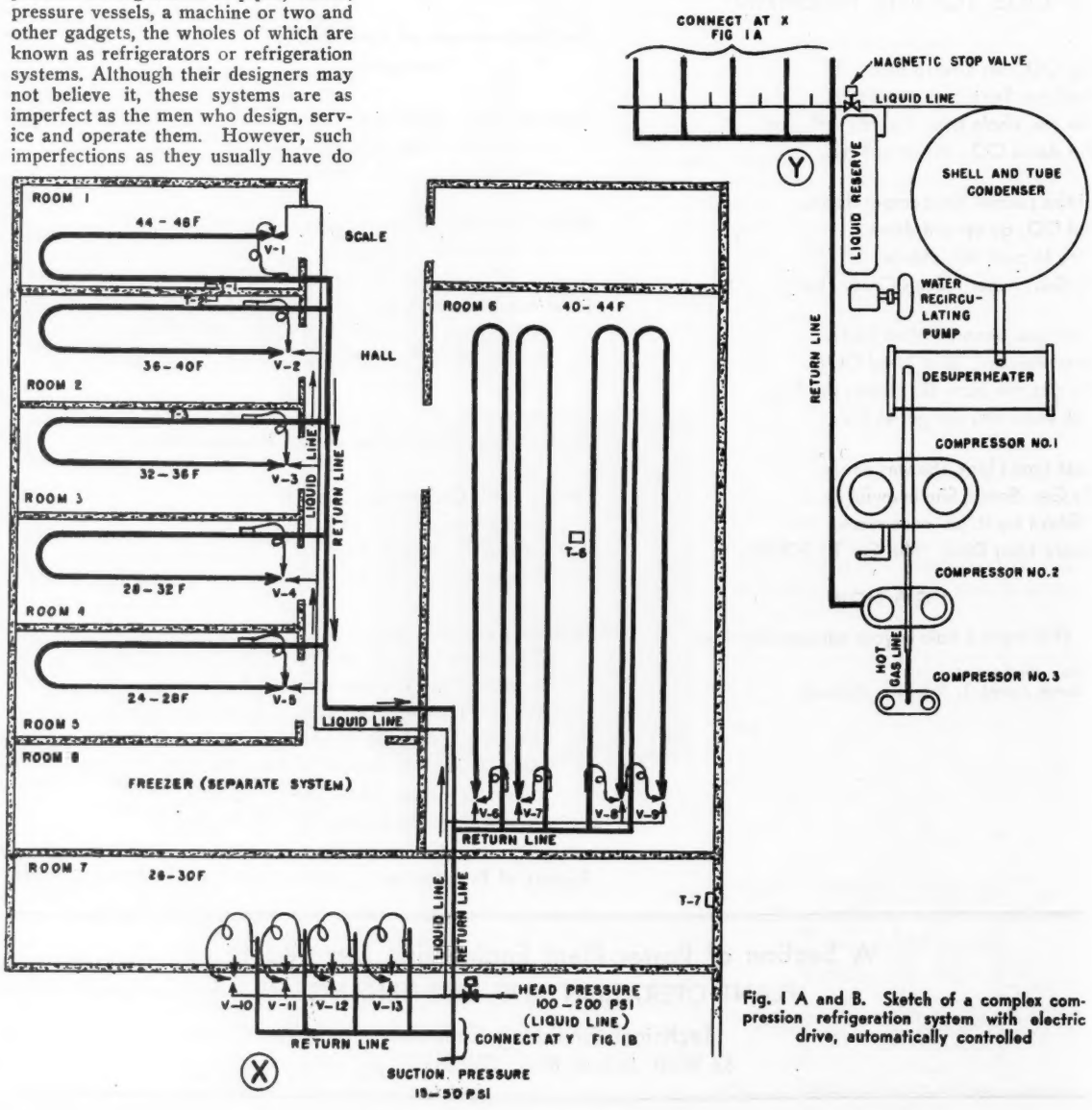


Fig. 1 A and B. Sketch of a complex compression refrigeration system with electric drive, automatically controlled

not keep them from being put to very good use. They are used to prevent food stuffs from developing halitosis, to freeze everything but liquid assets and to cool anything but a hot number at a Bohemian night club. They are especially used to give beer that final touch which makes the drinker's tongue wag like a pleased puppy's tail.

Kinds of Refrigerating Systems

Refrigeration systems are of several kinds, distinguished by such well-meaning but incomplete terms as direct expansion refrigeration system, absorption refrigeration system, compression refrigeration systems, blankety-blank refrigeration system, etc. The last named system is not recognized by designers or other authorities, but is a general term applied by service men and operators to any system which, contrary to its very purpose, makes them hot instead of cold. Although any refrigeration system may develop characteristics which make it deserving of this unusual title, many service men and operators are convinced that some of them are purposely so designed. Certainly many operating engineers would like to have the system they operate designed otherwise.

Regardless of size or capacity, a refrigeration system may be simple, complex or compound in its mechanical arrangement. In its simplest form, such as the common household or small commercial refrigerator, it consists of seven essential parts. These are: one expansion valve, one evaporator, one compressor, one condenser, connecting pipes or tubes, a volatile substance called the refrigerant and power of operation. The first five parts are as hollow as political promises, but are filled with the sixth. The first five parts are so interconnected as to form a closed, hollow circuit in which the refrigerant, impelled by the seventh acting at the compressor, goes around and around like the belle of the village ball.

This circuit of the refrigerant is divided into a low pressure side and a high pressure side. The low pressure side begins at the expansion valve and extends through the evaporator and return line to the compressor. The high pressure side begins at the compressor and extends through the hot gas line, condenser and liquid line to the expansion valve. There is often a troublesome side, which may begin at any point and extend around the circuit to any other point, or beyond. Often it runs off the circuit on to belts, wires, switches, or anything else connected with operation. Always it winds up at the operator. The presence of this side may be due to the operator's neglect, although it is often an unconscious by-product of the designer.

A complex refrigeration system differs from a simple one in having two or more low pressure sides, or branches. In large cold storages complex refrigeration systems are common, the low pressure side almost always being divided into as many or more evaporators as there are rooms to cool. The troublesome side increases with the complexity, and where complex systems are used to cool two or more rooms, there is special trouble in adapting them to automatic operation.

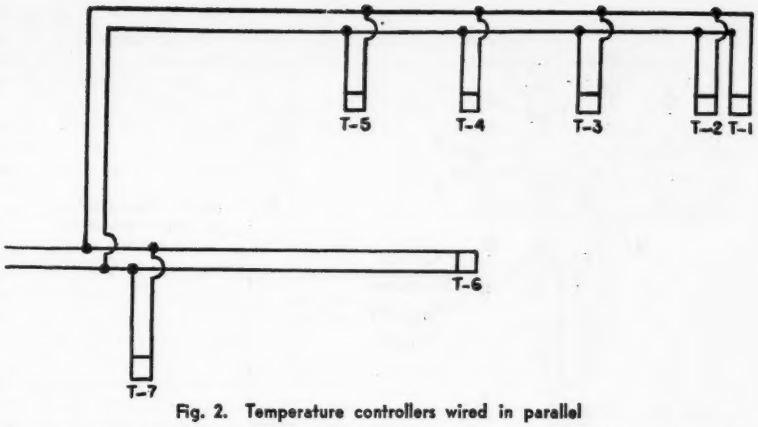
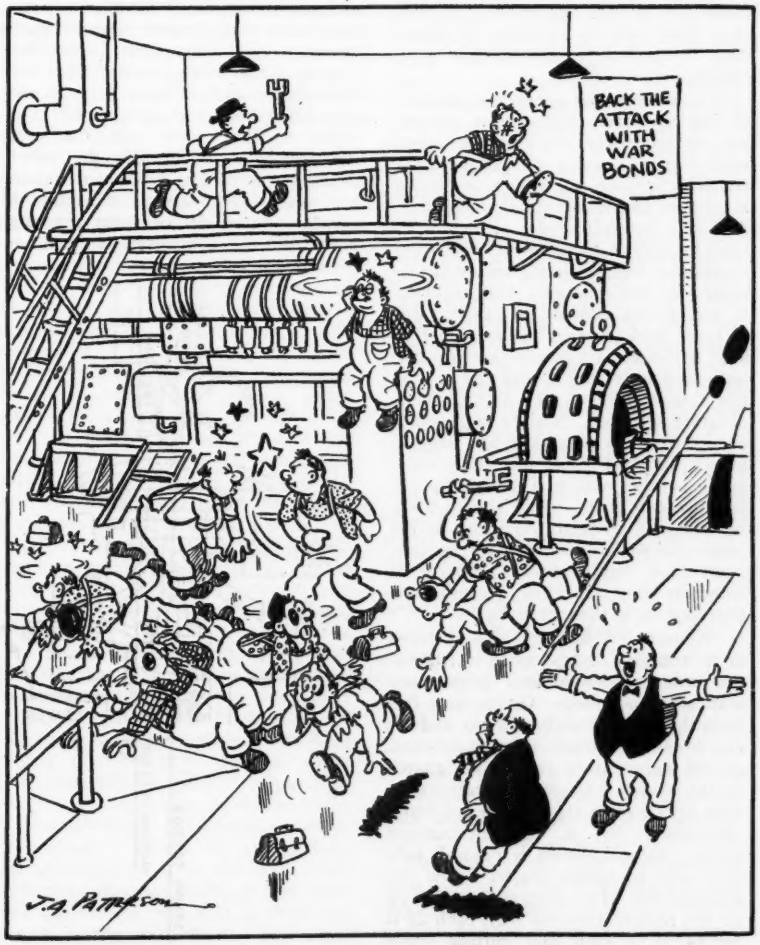


Fig. 2. Temperature controllers wired in parallel

Automatic control is easily applied to a simple system or to a complex system in which all evaporators are in the same cold box. Once set to maintain a given temperature in the box in which the evaporator is placed, a simple system with electric drive automatically controlled will hold that temperature under normal loads until a storm grounds the power lines or the power house floods again.

Control is usually by means of a thermally actuated switch. Whenever the temperature in the cold box rises, the switch closes and starts the com-



"It All Started Over Something About One of th' Boys Havin' a Steak Sandwich in His Lunch Box."

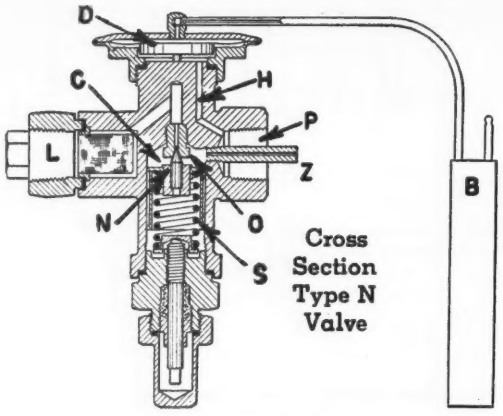


Fig. 3. Cross section of a thermoexpansion valve

pressor; and when the box reaches the required minimum temperature, the switch opens and the compressor stops. The switch may be directly actuated by a rise or fall of the pressure in the evaporator, by the rise or fall of the pressure in a bulb exterior to the evaporator, or by utilizing some other effect of temperature change. In all such simple systems expansion of the liquid refrigerant is automatically controlled by a float regulator or expansion valve set to operate in unison with the switch or temperature controller.

No matter how great the capacity of an automatic single cooler system, an engineer only slightly acquainted with the mechanics of refrigeration control can soon adjust it to maintain maximum and minimum temperatures. And if a multiple cooler system is to have its various coolers kept only below maximum temperatures, and with no regard to the minimum temperatures, it, too, is not difficult to adjust. But in some cold storages coolers must be kept within certain temperature ranges, lest foodstuffs be spoiled by a too low temperature as well as by a temperature too high. Should each cooler have maximum and minimum temperatures different from the other coolers in parallel with it, a complex problem presents itself. And should there be wide and frequent variations in the loads placed in the separate coolers, controlling temperatures properly is about as easy as riding an unbroken mustang in a thunderstorm.

Figures 1-A and 1-B are sketches of a complex compression refrigeration system with electric drive automatically controlled. This system has been in service eight years, and at one time the coolers were maintained at the temperature ranges designated in the sketch. Each evaporator consists of 500 ft of 1¼-in. pipe fed liquid refrigerant by a thermoexpansion valve. Air circulation is natural, subject only to baffles placed below the evaporators. The storage is made up of five coolers (Rooms 1-5), each 28 ft by 14 ft, a chill and cutting room (No. 6) and a storage room (No. 7). Each of the coolers has one evaporator, while the two larger rooms have four each, a total of 13 evaporators in parallel containing 6500 ft of 1¼-in. pipe.

The thermoexpansion valves are of the double push-pin type (Sporlan), internally equalized and each of 1-2 tons capacity, a maximum for the system of 26 tons. Since few of these valves were expected to operate at capacity at any given time, the designer allowed a ten ton constant speed compressor calculated to operate fourteen hours daily under normal load. There is one temperature controller in each of the seven rooms. They are wired in parallel (Figure 2). Should any single room warm up, the controller in that room will start the compressor, even though the other rooms are as cold as a Russian winter.

Condensing water is constant in quantity, being drawn from the city mains into the condenser pan and recirculated over a cooling tower and shell-and-tube condenser by a centrifugal pump. Two other automatic electric driven high speed compressors (Nos. 1 and 3, Figure 1-B) discharge intermittently into the same condenser, with its constant water supply. For these reasons the condenser pressure varies widely, often going up and down as fast as a Spitfire in a dogfight. At any given moment the head pressure depends on such factors as wind and wet bulb temperature, number of compressors operating, their suction pressures, etc. With low suction pressure and only the No. 2 condenser operating, and with a cool, dry wind blowing, condenser pressure may be as low as 75 psi. But with all compressors working at high suction pressures, and with the outdoor air still, hot and humid, the condenser pressure may reach 225 psi or more. This high head pressure cannot be lowered without using excessive amounts of makeup water, as city water always reaches a summer temperature of 85 F.

During the off cycle a magnetic stop valve closes the liquid line, and while the compressor is idle the suction pressure rises normally to 50 psi. The suction pressure while operating fluctuates somewhat, depending on how many rooms have warmed up, head pressure, etc. With the compressor of this system operating at low head pressure on a single cooler, while the other expansion valves are almost closed off, back pressure may be as low as 5 psi. But if all evaporators should be operting near capacity, back pressure may be 25 psi or above.

As a basis for beginning an analysis of system performance assume that all coolers have simultaneously reached

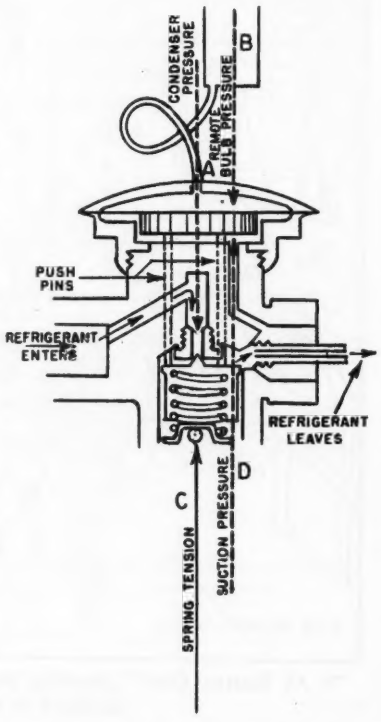


Fig. 4. Diagram showing forces acting upon a thermoexpansion valve

To open valve

A. Pressure of liquid on needle. Since the orifice is very small the total pressure at this point is negligible

B. Pressure of the power fluid in the remote, or feeler, bulb. Under normal operation, this force is greatest of all

To close valve

C. Spring tension, adjustable from zero to 50 lb or more

D. Evaporator pressure, acting through equalizer hole. Except when valve is tightly closed, A plus B always equals C plus D. At the start of the operating cycle, D is at its maximum, as likewise is B if room temperature is at its maximum. B will remain at its maximum while D is rapidly reduced by the action of the compressor. As D is reduced, A and B overcome C and D, and open the valve. But as the cold gas passes through the evaporator to the bulb, B is reduced. C and D then close the valve

If power fluids with fast-breaking pressure-temperature curves could be developed a far-reaching step in minimum temperature control would be taken

their maximum temperatures, and that all controllers have closed to start the compressor. At the same instant the magnetic stop valve opens and lets liquid refrigerant flow into the thermoexpansion valves, a type of which is shown in Fig. 3. Although the fluid charge in the bulb B, acting through the diaphragm D and the push pins (not shown) is exerting its maximum pressure on the needle carrier C to push the needle N away from its seat O, the valve will remain closed if there is much tension on the spring S. Of itself, however, this spring tension is not enough to hold the needle against its seat, but is assisted by the pressure in the evaporator acting through the equalizer hole H to oppose the bulb pressure from the opposite side of the diaphragm. Figure 4 shows how the two forces tending to open the valve are opposed by the two forces tending to close it.

As the operating cycle proceeds, the compression pumps down. The evaporator pressure acting from P through the equalizer hole H opposes the bulb pressure less and less. Since the spring tension remains constant, the pressure of the power charge above the diaphragm begins to push the needle away from its seat. Liquid enters the valve at L, passes through O and sprays out the distributing nozzle Z. As it passes through the evaporator, the liquid boils away. On reaching the place where the bulb is clamped on the pipe, the cold gas cools the power charge. This reduces the pressure in the bulb until spring tension acting beneath the needle, assisted by the lower evaporator pressure acting beneath the diaphragm, closes the valve and stops the admission of liquid to the evaporator.

If all valves have the same type charge in the thermostatic element and if all adjusting stems are backed out to zero tension on the springs, the valve in Room 1 should be the first to open, as the higher temperature of the bulb results in higher pressure of the power fluid acting above the diaphragm. With suction pressure 50 psi at the start of the operating cycle, a diaphragm of 1 sq in. area will have a total pressure of 50 lb pushing against it from below. If at 48 F the total pressure above the diaphragm is also 50 lb, the valve will be balanced, still assuming no spring tension and ignoring the slight total pressure of the liquid acting on the needle through the valve orifice (A, Fig. 4). In this case a slight drop in suction pressure at the start of the operating cycle will immediately cause the valve to open.

A casual glance at an ammonia pressure gauge or table of the properties of ammonia shows why it is possible to cool Room 1 with a suction pressure no lower than 45 psi. At this vapor pressure the liquid has a boiling point of 30 F, or 18 deg lower than the room maximum and 14 deg lower than the minimum. Even with natural circulation of air, it is possible to obtain a fair rate of heat transfer in this room and in No. 6 with a suction pressure of 45 psi during the whole of the operating cycle.

Further inspection of the suction gauge shows that at 45 psi little heat transfer can take place in Rooms 2 and 3, and none at all in Rooms 4, 5 and 7. In Room 5, which is the coldest, heat transfer cannot take place very rapidly until the suction pressure has fallen to 30 psi or lower. Therefore if Room 1 is only lightly loaded, the temperature there may be reduced to the minimum before heat transfer in Room 5 has commenced.

This brings the synchronizing of thermoexpansion valves and temperature controllers of this complex system to its first critical point. This critical point would not arise if the power assembly were charged with a volatile which would completely condense at 44 F, and consequently exert no further pressure on the diaphragm. The spring could be adjusted to keep the valve closed as long as the bulb remained below this temperature. Unfortunately for service men and operators, perfect power fluids condensing completely at each minimum temperature desired are not as yet on the market. Extra power assemblies charged with fluids which would exert zero pressure at certain temperatures, yet would be powerful five or ten degrees above those temperatures, would solve the problem of minimum temperature control.

Still assuming that all power elements contain the same type thermostatic fluid, the temperature of zero or near zero bulb pressure must be 24 F, or lower, since that is the minimum temperature in Room 5. Therefore in V-1 the fluid still exerts pressure at 44 F, and any relaxation of pressure beneath the diaphragm results in a re-opening of the valve. As the compressor pumps down to begin heat transfer in the colder rooms, liquid refrigerant again flows through V-1, and the spring tension must be increased to stop it. As a result, this valve will not open at once on the next operating cycle, but at some point lower than the off cycle pressure of 50 psi. In fact, due to the higher bulb pressure, spring tension in V-1 will be much greater at final adjustment than the spring tension of any valve of the system.

Final adjustment finds spring tension necessarily greater in the warmer rooms, in order to oppose the higher pressure of the power fluid. But for jerk loads in solitary coolers, this final setting of the spring tension might give satisfactory results. Operating conditions often make the setting highly unsatisfactory. Over Sunday, when the storage is closed, all coolers may fall uniformly to their minimum temperatures. Monday forenoon fifty hogs with the animal heat still in them are swung in the chill room. The compressor starts, and for twelve or fifteen hours, and often twenty hours, it runs, with the four chill room evaporators working at capacity. The other rooms reach their minimum temperatures, and the valves in those rooms begin to close off. Their closing causes the suction pressure to fall. Bulb pressure thereupon re-opens the valves, with the overall result that the lightly loaded coolers fall several degrees below their minimum temperatures.

On Tuesday these hogs are cut up and placed in Room 5 for rapid cooling preparatory to freezing. Since other coolers are used for specific foodstuffs, this 12,000 to 15,000 lb of pork cannot be distributed among them. The result is that the compressor runs twelve to fifteen hours on this single cooler. The suction pressure drops to 10 psi and would fall lower but for the valves in the other rooms reopening to further cool foodstuffs that are already too cold. On Wednesday the No. 3 cooler keeps the machine running all day and half the night, still further cooling the other rooms. Loads are received in such manner that any cooler may be next to keep the compressor almost constantly on the line. The low suction pressure and resulting high ratio of compression causes high discharge temperature. The lubricating oil breaks down, and the safety heads, discharge valves and upper piston rings are so carbonized as to leave the impression that the compressor has been firing like a Diesel.

The use of forced circulation would do much to solve the problem of jerk loads in the coolers of this system. However, fans should not operate continuously, as such an arrangement would nullify any change. The best arrangement would be to have a fan in each room set to blow upon the evaporator, and wired to start and stop with the controller. This would assure rapid heat transfer in the coolers holding the compressor on the line, raise the suction pressure and somewhat reduce the compression ratio. The running time of an underloaded induction motor would be shortened, and above all the various rooms would be held nearer their required temperatures.

CO_2 Filter

By L. E. Keck

ANYONE operating CO_2 recorders has probably had trouble with the carrier pipes plugging up, causing the meter to read incorrectly and requiring considerable maintenance.

This condition was corrected at one plant by the use of a filter made from a quart size Mason jar. The pipe leading from the boiler extends through the top of the jar about half way. Another pipe leads from about one inch from the bottom of the jar, through the top, to the meter. A wire screen is placed one-half inch from the bottom and the jar is then filled with spun glass.

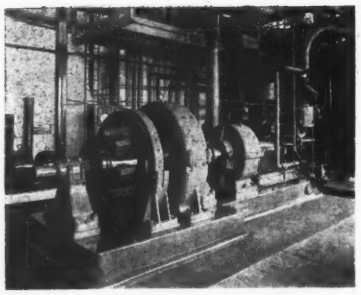


Fig. 1. A typical turbine driven d-c generator in an industrial plant

The Fundamentals of Paralleling

By A. C. NERENBERG
Engineer, Crocker-Wheeler Electric Mfg. Co.

THIS ARTICLE, in a condensed form, outlines the procedure to be followed for obtaining satisfactory operation of d-c generators when connected in parallel. These instructions will be of material aid to the field engineer confronted with the problems of paralleling d-c generators, and will cover all but the most unusual installations—which require the services of an engineer thoroughly familiar with the fundamentals of operation and design of electrical machinery.

Practically, satisfactory parallel operation may be considered to be obtained if all units take a share of the total load within the limits of approximately 5 per cent of their exact proportional share.

In general, compound-wound direct current generators have either a flat or rising voltage characteristic and, therefore, are inherently unstable when operated in parallel unless an equalizer connection is used. The equalizer connects the series fields of all generators in multiple, thus permitting the flow of current from unit to unit through a very low resistance path—resulting in satisfactory parallel operation, provided the following conditions are observed.

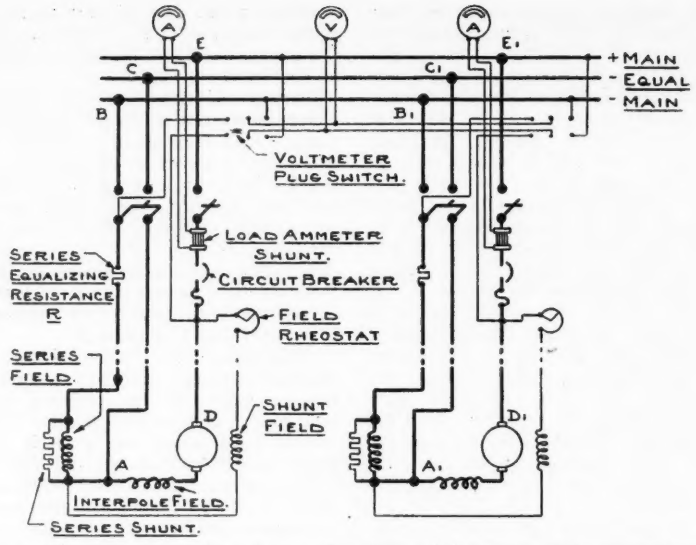


Fig. 3. Generator and switchboard connections for parallel operation of 2 compound-wound interpole generators

1. The prime movers should have approximately the same percentage speed drop from no load to full load. For steam turbines the drop will be 2-3 per cent, while for Diesel or gas engines it varies from 2-6 per cent. In addition, the speed-load curves of all units should very closely approximate a straight line.

2. The series field shunts should be chosen to give the same voltage regulation on all generators; for example 240 v no load, 240 v full load, or if 5 per cent overcompounded 240 v no load, 252 v full load.

3. The resistances of the individual circuits from the point of equalizer connection through the series field and shunt circuits and the connecting cable to the common bus should be inversely proportional to the full load currents of the generators. These resistances may be proportioned by selecting the proper size cables, or by inserting external resistances in the lines. For generators of different sizes or different designs, where there is an appreciable difference between series field resistances, special adjustments in circuit resistances are necessary to obtain a satisfactory division of the load.

4. Where the generator load voltage curves are not identical and cannot be made so, proper paralleling can be obtained by adjusting the speed regulation of the prime movers. Adjusting the speed drop setting on the governors will bring the compounding curves of the generators into closer agreement. If one generator tends to take more than its share of the load its speed drop should be increased. If less, the speed drop should be coordinated with the generator compounding to obtain the desired external volt ampere characteristics.

Equalizer connections should be of ample cross section . . . a good rule is that the equalizer should be the same size as the main cables to the bus bars. The equalizer prevents unstable parallel operation by allowing current to flow through a very low resistance circuit from the generator tending to have the higher voltage (as when there is a momentary increase in speed), through the series fields of the normal (lower) voltage generators, thus causing the lower voltage machines to increase their voltage to a point where they are again taking their share of the load.

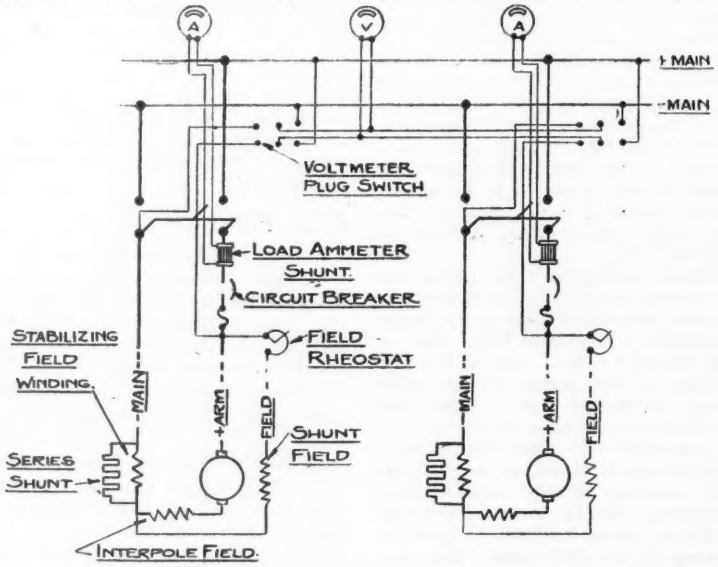


Fig. 2. Generator and switchboard connections for parallel operation of 2 stabilized-shunt-wound interpole generators

Three-wire, dual voltage generators may be operated in parallel by using two equalizers, one on each side of the armature. If three-wire machines are operated in parallel with two-wire machines, it is necessary to split the series fields of the two-wire generator to permit the use of two equalizers. One half of the series field is put in series with the positive side of the armature, and one half in series with the negative side of the armature.

Two- and three-wire generators of the stabilized shunt type are inherently stable in parallel, and share the load properly without the use of an equalizer connection, provided their load-voltage characteristics are the same (a minimum of 5 per cent drop from no load to full load), and are of similar shape. This condition can be obtained by adjusting the series field shunts and the speed drop settings of the prime mover governors. A slight shift of the generator brushes is permissible if necessary to obtain the required voltage drop curve.

If the foregoing is provided for, each generator will take its proportionate share of the total load because any tendency of one unit to "hog the load" would be overcome by a drop in its voltage, and resulting lightening of the load on that particular machine. As one unit takes a greater share of the load, the other units take a smaller share, causing their terminal voltage to rise . . . thus bringing the load division back to normal. Thus it is obvious that stabilized shunt generators are ideal for parallel operation.

PRACTICAL HINTS AND KINKS

Six Things to Remember When Using Today's Solders

TODAY'S SOLDER decidedly differs from pre-war solder, and so should soldering technique. Previously solder was composed of tin and lead in about 50-50 ratio; today, except for certain applications, solder contains not more than 20 per cent tin, with perhaps small amounts of silver, bismuth, antimony or tin. Today's soldering technique calls for a hotter soldering iron, and attention to certain details. How to make better soldered joints has been explained in a communication issued by the metallurgy committee of the General Electric Company, which says:

1. Keep your work clean. Guard carefully against varnish, grease, oil, dirt, rust, or corrosion products. They prevent the flux from acting and the solder from alloying with the parent metal.

2. Keep in mind that the purpose of the soldering iron or torch is not to melt the solder but to heat the work until the solder will flow when applied to the work.

3. Keep the soldering iron clean and, to have the quickest possible heat transfer from the iron to the work, have the tip designed actually to fit against the work.

4. Investigate different methods available for doing the work—hotter electric iron, high frequency, or carbon resistance soldering tools may do the job better.

5. Design your joints to have 0.003 to 0.005 in. solder thickness, and so that the two parts overlap. Lap or seam type joints are better than butt-type joints. Have the solder fill the seam completely. Heavy fillets add little strength to the joint, and waste solder.

6. Don't hand a new solder, a flux, and a soldering job to a workman and expect a perfect job the first time. Let him get the "feel" of the new material. Don't give up a new solder after one unsuccessful trial—the chances are your technique is not what it should be for that particular solder.

Ratchetless Ratchet Wrench

WHEN INSPECTORS and maintenance men in the induction furnace department at General Electric's Schenectady Works found it necessary to reach a considerable number of hollow-head screws in out-of-the-way places, Inspector Raymond Hodge solved the problem by devising a "ratchetless" ratchet wrench of small diameter.

The usual ratchet wrench has a toothed wheel and pawls; the "ratchetless" one depends on the clutch action of a tightly coiled spring that permits one-way rotation only.

The body of the wrench is composed of two cylindrical parts (A and B in sketch). The wrench was made to accommodate a ½-inch hexagonal head, but any adapter may be used in place of the hexagon for other screws. When part A is inserted in B, a pin through D and extending into the groove of part A permits free turning without separation.

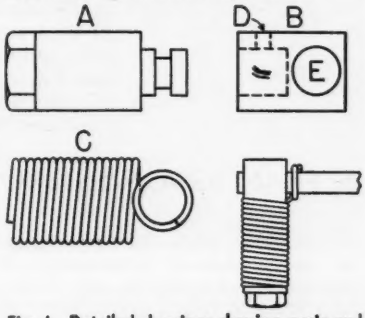


Fig. 1. Detailed drawings showing parts and construction of the ratchetless ratchet wrench

Spring C, it will be noted, is tightly wound on a mandrel slightly smaller (0.005 in.) than the diameter of the parts A and B. The spring is pressed over parts A and B, with the loop of the spring over the drilled hole E. Inserting a 5/16-in. rod through the loop and into the hole E locks the looped end of the spring with respect to B.

If the spring is wound clockwise, then any clockwise turning of the rod tends to tighten the spring, to tighten the grip of the spring on A, and hence to tighten the hollow-head screw. Turning the rod counterclockwise loosens the coils of the springs, permitting B and the spring to turn without turning, or loosening A. By a series of short back-and-forth movements of the rod it is possible to drive the screw.

If the coil is wound counterclockwise, then such a back-and-forth movement removes the screw.

Mr. Hodge provided two wrenches for the work—one with a clockwise-wound spring for use as a driver and painted red for easy identification, and the other with a counterclockwise-wound spring for removing the screws.

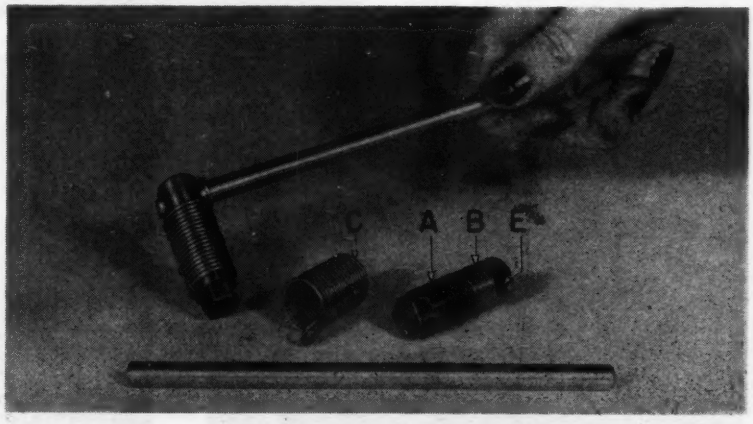


Fig. 2. Spring ratchet-type wrench for special applications

Roller Chain Drives Meet Difficult Conditions

In this article Mr. Westbrook describes a number of power transmission problems which were solved or improved by the use of roller chain drives. In places where dust and grit is present, chain drives provide effective and economical means of transmission and they lend themselves to a variety of applications

By FRANCIS A. WESTBROOK

THE USE of finished-steel roller chain for the mechanical transmission of power is found in almost every industrial field and under a great variety of conditions. It includes the carrying of heavy and light loads at high, low and moderate speeds, second reduction power drives, intermediate built-in drives, for the close regulation of machine speeds, for coordinating the motion of more or less distantly separated shafts of one machine, etc. Alternate directions of rotation of shafts on the same machine are also easily obtained by winding the chain back and forth over a series of sprockets, as the chain can run on either side.

Roller chains are also sometimes used for the direct drive from a motor to the driven machine, and are especially satisfactory where high speed operation on short centers is involved. The transmission of power is smooth, the speed reduction may be as much as 15:1 and the power transmitted may be anything from fractional to 1000 hp.

Another very important consideration in these times where waste of time, power or interferences with production schedules cannot be tolerated, is that a properly designed chain drive eliminates loss of power due to slippage and reduces maintenance to a minimum. Another advantageous feature about chain drives is that the materials of which they are made may be stainless steel or bronze where there is exposure to excessive moisture, chemicals, corrosive vapors and high temperatures.

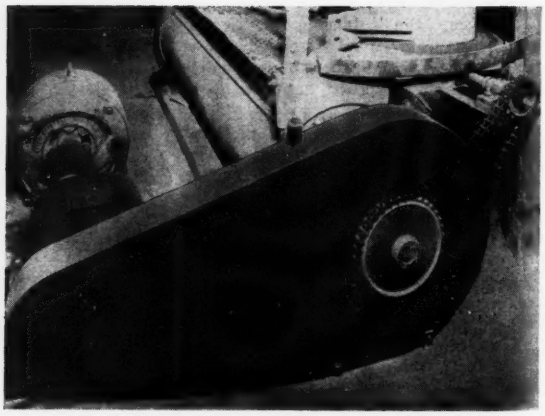
In order to show more clearly how the features touched upon work out in practice a few examples from different industrial fields will be considered. A very interesting instance is found in a Chicago boiler works where there is a stationary arc welding machine and a traveling carriage on which the work to be welded is supported, shown in Fig. 1. There are seven chain drives, thirty-one roller bearing pillow blocks, a herringbone-gear speed reducer and a hand-lever-operated square jaw clutch involved in the power transmission set-up for moving the carriage and turning the work as it is being welded. That is, there is a 3 hp motor with a variable speed transmission, speed reducer and two chains in the drive for propelling the carriage; four individual roller chains for driving wheels for turning the work and a double width roller chain from the speed reducer output shaft to the longitudinal lineshaft from which the four individual drives to the wheels for turning the work are operated. Obviously it is essential that the various drives involved in this set-up be accurately synchronized at all times, which of course is only possible by the means employed unless gearing were used, which would be noisy and more expensive in first cost and to maintain, not to mention less efficient as regards frictional losses.

The modernization of a pug mill drive in a Colorado plant illustrates the advantages of up-to-date power transmission equipment very vividly. The old and new drives are shown in Figs. 2 and 3 respectively. As will be seen the old drive consisted of unprotected gears which were noisy and set up annoying vibrations. As gears were unprotected the wear from the dust

Fig. 1 (Right). Motor operated welding machine with 7 chain drives installed in a Chicago boiler works

Fig. 2 (Below, left). Old exposed flat belt and spur gear drive for pug mill

Fig. 3 (Below, right). New pug mill provided with enclosed, automatically lubricated drive with herringbone speed reducer and roller chain. Pintle shown exposed is normally enclosed



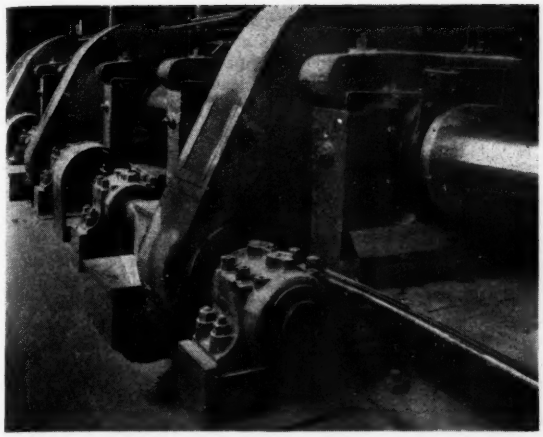


Fig. 4 (Above, left). Roller chain drives from power line shaft to rubber mills. Drives operate in oil-retaining casings
Fig. 5 (Above, right). 600 hp roller chain driving one 84-in. and three 60-in. rubber mills
Fig. 6 (Right). Drive for glass drawing machine, including roller chain, herringbone speed reducer, cut tooth bevel gears and flexible coupling

and grit to which they were exposed was excessive and the lubrication expensive. As a 35 hp motor is involved with a belt and spur gear drive, it can readily be understood that the frictional losses were considerable.

The new pug mill drive comprises a double reduction herringbone-gear speed reducer, a flexible type roller chain coupling and an encased roller chain to the pug mill drive shaft. This new drive is entirely enclosed and runs in oil. It is neat, compact, is easy and economical to maintain and safe. The operator has better access to the mill as considerable floor space is saved and there is no more vibration.

The chain drive with the casing removed, shown in Fig. 3 is a closed joint malleable iron pintle chain which operates the disc feeder to the mill, and replaces a less efficient drive at this point.

Another instance of modernizing drives by means of roller chains is shown in Fig. 4. Here several rubber mills are driven from a common lineshaft. The old method of driving these rubber mills from the lineshaft was by means of spur gearing, resulting in very objectionable vibrations and excessive noise. The modernized drives consist of five 100 hp and two 40 hp double width roller chains which operate the same five 60 in. and two 26 in. rubber mills, respectively. These chain drives run in oil-retaining casings. They have eliminated the vibrations and operate so quietly that they cannot be heard unless the ear is placed close to the casing. In making this change-over a minimum disturbance of existing equipment was called for, greatly facilitated by the fact that the center distances may be whatever is convenient under the circumstances. Fig. 5 shows a 600 hp quintuple width roller chain from the motor to the lineshaft from which an 84 in. and three 60 in. rubber mills are driven in the same plant.

Fig. 6 shows a drive of small hp which is interesting because of the excessive heat in which it must operate. The view is of a glass machine whose rolls are driven by a 1½ hp variable speed motor. The drive shown consists of a roller chain flexible coupling between the motor and a double reduction herringbone-gear speed reducer and from the latter to the vertical shaft on the glass machine there is a roller chain drive with a 3.125 to 1 ratio. Cut-tooth spur and bevel gears drive the individual rolls of the glass machine. It is of course essential that all of these drives operate in synchronism and that there be no slip. They must also operate continuously which means that wear must be reduced to a minimum. Finally the temperature in the vicinity of this machine ranges between 150 and 200 F. Ventilation is not possible because of the fact that it would crack the sheet of glass.

These days it is particularly important to get all possible service out of chain drives as with all other items of industrial equipment. Adequate care and maintenance will also result in a minimum of service interruptions and interferences with production schedules, as well as longer life. A point to bear in mind in this connection is that practically all machinery is operating several times as many hours per day and week as formerly, which means faster wear, of course. By following five simple rules for the maintenance of the chains the results will be found very much worthwhile.

The first rule is to see to it that the sprockets are properly aligned in order to avoid side pull and the corresponding excessive wear of both chain and sprocket on one side. Chains should be run with somewhat more slack than belts as too much tension causes unnecessary wear of the chain and undue friction on the bearings. However too much slack is likely to permit the chain to jump the sprockets or ride the teeth and break. Third, when the chain does not run in oil it should be lubricated with good light cylinder oil applied to the joints with a paint brush on the upper, or open, side. With closed joint chains the oil should be applied to the upper side of the lower run. Fourth, a chain not running in oil should be cleaned regularly by taking it off and dipping in kerosene. It should then be dried and oiled as already explained. Fifth, it is important to make sure that the sprocket teeth are not worn to an extent to injure the chain. Cast teeth which are worn may be improved by grinding the teeth, but if the teeth are badly worn the sprocket should be replaced with a new one.

How Would You Do It?

PROBLEM 30. THE PROBLEM OF THE HIGH PRESSURE STILLS

WHATEVER doubts Our Hero may have had in regard to his "still" problem before we presented his question in the September issue, he still (no pun intended) is little better off, now, that the answers have come in. This is not the fault of those who were good enough to try to answer his question for him; it is due to the fact that this is one of those problems which permits of several solutions, the best one depending upon factors which only Our Hero can apply. In other words, despite the fact that Our Hero, no doubt, tried to give all the information necessary to solve the problem, there were a lot of things left unsaid. For example, in the statement of the problem, the turbine was shown with an extraction point at 20 lb pressure. This was clear enough, and, offhand, it might be assumed that this information was enough to work with but one of the first questions that comes up in an attempt to solve this problem is whether there are any other extraction points on the turbine. If there is an extraction point say at 75 or 80 lb, it is obvious that this point could possibly be made to serve the new battery of stills. Another thing regarding which more data should have been given is the size of the reducing valve, that is, its capacity. Supposing the setting can be changed so that it will reduce 250 lb to 75 lb, will it have enough capacity to supply the steam required by both sets of stills? These are only some of the questions that were asked by those who submitted answers to the problem.

All of which strengthens our belief, which we have held for some time, that Our Hero is somewhat of a dope; otherwise, why would he submit screwy problems like this? Our distinguished or more correctly, our extinguished, Board of Judges, exhibited little interest in the problem, as such. They did seem to be interested in the stills, however. The chief justice, it appears is somewhat of a connoisseur when it comes to stills and he spent much of the time during the deliberations, regaling his colleagues with accounts of the merits of a particular corn mash formula. With liquor becoming more difficult to get every day, he (the chief justice) felt that it would be a good idea to acquire the new stills and thus relieve Our Hero of all his troubles. In the end, however, they did take enough time off to glance over the solutions that had been submitted and without much fuss or ado, they awarded the prizes. The final disposition of the stills continues to intrigue them, however.

While there was some difference of opinion in regard to the merits of different schemes for solving this problem, most of the solutions submitted were similar. They involved either a change in the extraction pressure or changing the setting of the reducing valve, or both. In this case the steam line to the factory building would be operated at 75 lb instead of 20 lb and there would be another reducing valve installed in the factory building to reduce the 75 lb pressure to 20 lb for use on the old battery of stills.

The use of a superheater to heat the steam to the temperature demanded by the new stills was not given very much consideration, indeed it was discouraged, and rightly so because, as was pointed out, the superheat would not make use of the latent heat of the steam. However, as Captain Chadwick, who won the third prize award, points out, the installation of a superheater in the *boiler* would help materially because in this way the efficiency of both boiler and turbine would be improved.

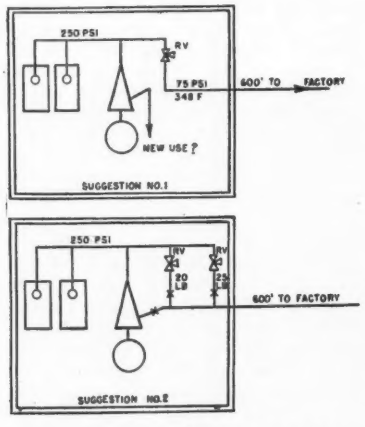


Fig. 1. Two of the suggestions made by Jesse L. Erisman

Strangely enough, in all the letters received, only two considered the use of a steam booster pump or similar device. A steam compresssor installed in the factory near the high pressure stills would take the 20 lb steam and compress it to 75 or 80 lb and at the same time raise the temperature of the steam to higher than the 340 deg called for by the stills. The only drawback to this arrangement is the notoriously low efficiency of the steam compressor but in emergency times such as these this might not restrict its use. It will be noted that Jesse Erisman who received first prize suggests this use of a steam compressor.

C. G. Clark, the second prize winner, suggests what he calls a "thermo-compressor" to do essentially the same thing. A thermo-compresssor is an ejector. By installing it in the 20 lb line it would compress a part of the 20 lb steam to the required pressure of 75 lb. Again, like the steam compressor its efficiency is rather low but the fact that it can be used for this purpose is interesting.

The prize-winning solutions are listed below. First prize was given to Mr. Erisman because of his very complete analysis of the problem and the systematic way in which he presents his three alternative schemes. In each case, he presents the solution and then lists the advantages and disadvantages. He, furthermore, was one of the few to suggest alternate operation of the stills. If the stills do not have to operate 24 hr a day, the 75 lb stills could be operated while the 20 lb stills were off and vice versa.

FIRST PRIZE AWARD

Jesse L. Erisman
St. Louis, Mo.

In problem 30, "Our Hero" will probably use the solution that calls for the materials most easily obtained, so I offer several suggestions.

SUGGESTION No. 1

The new stills call for a 340 F temperature. At 75 psi the steam would have to be superheated about 20 deg to satisfy this requirement, since the saturated temperature at this pressure is approximately 320 F. Assuming the 250 lb steam to be dry saturated, the above requirements could be obtained most easily either by changing the present 250/20 lb reducing valve setting to 250/75 lb or using another 250/75 lb reducing valve in its place, since the present valve is probably too small to handle the additional load. Anyway, its capacity would be further reduced by operating at the lower pressure differential. The extraction line could be disconnected.

In expanding by throttling from 250 psi, dry saturated, to 75 psi, the final temperature would be approximately 348 F, since the total heat remains practically the same. This degree of superheat, of course, is equal to the total heat at 250 psi, minus the latent heat at

75 psi saturated, divided by the specific heat of superheated steam at 75 psi. The advantages of this suggestion are:
A. Low first cost.
B. A minimum of critical materials.
C. Inasmuch as the old stills require steam partly from reducing valve, then the increased demand would probably have to come from a reducing valve anyway.
D. The higher pressure would increase the capacity of the 600 ft line and also the capacity of the old stills, if they can be operated at 75 psi.

The disadvantages of the above are:
A. A new use might have to be found for the extraction, since not to use it might affect the power of the turbine, due to insufficient condenser capacity.
B. 75 psi might be too high for the old stills, thereby necessitating another reducing valve in factory building to operate at 75/20 lb.
C. Higher temperature on old stills might cause faulty operation due to local hot spots in the first part of the heating coil.

SUGGESTION No. 2

It is not stated in the problem as to whether the new and old stills are to be operated simultaneously, or not. If the manufacturing process is such that they will not be operated simultaneously, then the 600 ft line could be used for first the one pressure and then the other. This would require a 250/75 lb reducing valve for the new stills.

The advantages of this suggestion are:
A. The specifications of both stills are satisfied.
B. When using old stills the 20 psi extraction could be used.

The principle disadvantage would be the inconvenience of changing over valves in the power plant when changing from one operation to the other. And the extraction could not be used when operating the new still.

SUGGESTION No. 3

If the 75 lb pressure called for is not necessary for sufficient velocity through the heating coils, then the new stills might operate at 20 psi if superheated to 340 F. If this were true, then Our Hero could use his separately fired superheater. However, with the attendant problems of the superheater, I believe another 600 ft line could just as easily be installed. Since such low pressures are carried, second hand pipe could be used.

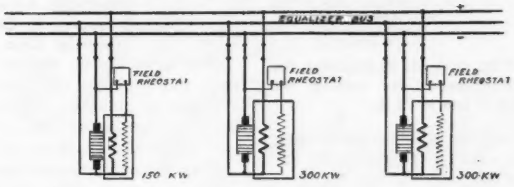
Our Hero's problem could also be solved by using a compressor to raise the 20 lb steam to 75 psi. This would also superheat the steam to a temperature probably 75 deg higher than the 340 deg called for, since the heat of compression would have to be added. However, unless a compressor was on hand another line, even in this case, would probably be easier to obtain and more economical.

SECOND PRIZE AWARD
C. G. Clark
St. John, N. B., Canada

Under existing conditions the best solution to the type of problem confronting Our Hero is usually the one involving the least amount of material and labor. Such a solution may not be the most desirable or economical but in many instances the operating engineer has no choice if he is to keep his plant in operation.

It is assumed that both the new and old stills are heated by closed systems. If this is so a separately fired superheater would not be satisfactory for the new stills since in the presence of condensate the temperature would be the saturation

Problem 31
TROUBLE WITH THE PARALLEL OPERATION OF D-C GENERATORS

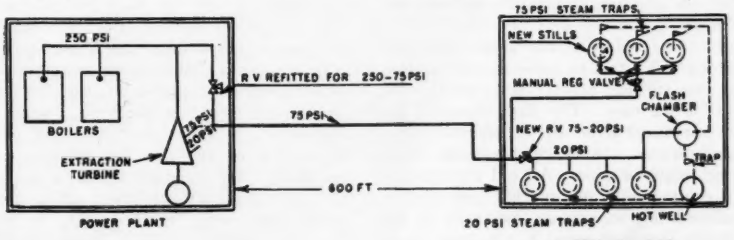


As many of you who read these columns probably have suspected for a long time, what Our Hero knows about electrical matters, could be written on a postage stamp or something smaller. Imagine putting a direct-current problem up to us in these days of electronics! However, we told him you fellows would tell him what to do, so here is an account of his latest headache.

For a number of years he has been operating two, 300-kw, 250-v, compound-wound, d-c generators in parallel without any trouble whatever. Recently, he had added another unit, a used 150-kw unit of similar design and engine driven like the others. Since this new unit has been installed, however, he has been having considerable trouble with sparking at the brushes, not only of the new machine but also of the old units. Quite obviously, this sparking is due to unequal loading because any one of the generators will carry full load and more when operating alone. It is only when the small unit is run in parallel with the others that the trouble starts. The machines are connected as shown with equalizer bus but, in this case, the equalizer does not help very much. So, Our Hero wants to know what he should do about it.

What do you think is the trouble and how would you go about locating and curing it? What suggestions can you make? Sure, it is a simple problem, but what of it? We will award a $25.00 war bond for the best solution and prizes of $10.00 and $5.00 respectively for the second and third best solutions. Here's a swell chance to pick up some easy money.

Send us your comments in a letter of not over 1000 words by November 30. Entries should be marked Problem 31 and should be addressed to the Contest Editor, Technical Publishing Co., 53 West Jackson Blvd., Chicago 4, Ill.



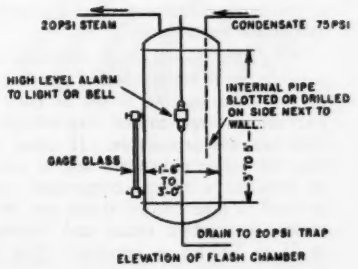

20PSI STEAM
CONDENSATE 75PSI
HIGH LEVEL ALARM TO LIGHT OR BELL
INTERNAL PIPE SLOTTED OR DRILLED ON SIDE NEXT TO WALL.
GAGE GLASS
1'-6" TO 3'-0"
DRAIN TO 20PSI TRAP
ELEVATION OF FLASH CHAMBER

Fig. 2. G. N. Clark's plans call for a flash chamber to flash 75 lb condensate and so permit the steam to pass to the 20 lb system

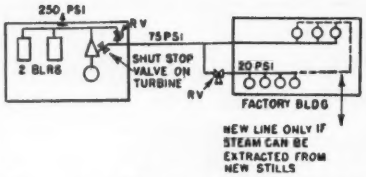


Fig. 3. Jack Pitts suggests abandoning the use of extraction steam and running the 600 ft line at 75 lb

temperature for the pressure and superheated steam would not persist far beyond the inlet nozzle.

The accompanying sketch (Fig. 2) illustrates the proposed solution to the problem. The existing reducing valve is adjusted to such a pressure as to give 75 psi at the new stills. This may involve some new parts for the valve depending on the type. The exact pressure at the reducing valve will depend on the piping details and the maximum rate of steam flow. It should be enough higher than 75 psi at the stills to allow for some regulation. If the reducing valve can be adjusted from 75 to 100 psi the best point can be readily determined in the field.

If there is an extraction point on the turbine at 85 to 90 psi it can be connected in place of the present 20 psi line as indicated. A new reducing valve will have to be provided at the old stills suitable for passing the required volume of steam at 75 to 20 psi. If close control of the old still temperature is not essential manually operated valves may be good enough provided that the heating systems are safe for the extreme pressure possible of 75 psi. Valves at the new still steam inlet can be manually operated or automatic as required. This will depend on the regulation desired, the size of steam piping, and the variations in steam demand.

Since it is probable that both old and new stills are fitted with steam traps some increase in economy can be obtained by flashing the 75 psi condensate in a small chamber allowing the steam to pass to the 20 psi steam system and the low pressure condensate to then discharge to the hot well or other process use. The value of the steam thus obtained will offset to some extent the loss of the turbine extraction connection if this is the case. The flash chamber can be purchased from one of several manufacturers or can be readily made from steel plate or pipe. An old air receiver if refitted with an internal pipe can be utilized in the manner indicated in the sketch if it will stand 20 psi steam pressure. A high level alarm should be fitted to the flash chamber to give a signal of dangerous water levels.

A great many other solutions are possible but to supply such a small quantity of steam as 1000 lb per hr does not warrant a large capital expenditure if materials are procurable. If other turbine extraction points are not, or cannot be installed a thermo-compressor could be used to take 250 psi steam and 20 psi turbine extraction steam and discharge at 75 to 100 psi as required. The best method can only be determined when all factors such as total annual cost can be evaluated from complete data. The method proposed uses the least possible amount of new equipment.

THIRD PRIZE AWARD
Captain George R. Chadwick
Fairfield, Ohio

Based upon the meager facts given with the problem and in view of the difficulty of obtaining labor and material under present conditions, your hero can best solve his problem as follows:

Tap the extraction turbine at a higher pressure stage. This would be at a point where the pressure would be enough above 75 psi to take care of the pressure drop through the 600 ft line and since the steam flow to the old stills is not given, it is impossible to compute it.

The point of extraction at which to obtain the desired pressure could be obtained from the manufacturer of the turbine or determined experimentally by tapping at different points and installing pressure gages.

After this was done, all that would be necessary would be to change the setting of the pressure reducing valve and make the necessary piping connections. In the event that this higher pressure steam is too high, either as regards pressure or temperature for the old stills, a pressure reducing valve could be installed or steam could be taken from the new stills at a point where the pressure has been reduced to the desired 20 psi. However, this would not allow Our Hero to use the old stills unless the new ones were being used too. Then again, if we knew the relative amounts of heat required between the new stills and the old stills, it might be possible to install a superheater and run the steam through the new stills first which would use the heat of superheat and then pass the steam through the old stills. It is not likely, however, that this would work because the heat (Btu) requirements of the old stills would have to be approximately ten times as high as the new stills, assuming about 200 deg of superheat. It is for this reason that simply superheating the steam to obtain the desired temperature would not work. It would require much more steam since only the heat available at the higher temperature would be the heat of superheat which is only about 0.5 Btu per lb per deg or 100 Btu for 200 deg of superheat. This compares with a latent heat of about 960 Btu given off if the steam condenses. To be exact, if we superheat the 20 psi 270 F steam to 340 deg, we would increase the total heat from 1166.7 to only 1216, or only 50 Btu per lb.

However, if the material were available, Our Hero could improve operating conditions materially by installing a superheater in the boiler. Both boiler and turbine efficiency would be improved and the investment would be worthwhile, especially since there is an additional load being added to the boiler.

Comment on Other Solutions

It is evident from the suggestions made in the letters presented above that Our Hero will still have to do some close figuring himself. He alone knows all the facts and must decide for himself, which is the most desirable course to follow.

Other letters submitted, gave him essentially the same advice as that contained in the suggestions above. Jack Pitts of Bloomingdale, Calif., advised merely closing off the extraction line from the turbine and raising the pressure in the 600 ft line by changing the reducing valve setting and then adding another reducing valve at the factory as shown in Fig. 3. Also, he says, "If the new high pressure stills are of the type that permit bleeding steam at 20 lb pressure, then add a new line from the new stills to the old stills to the old 20 lb header to make up any deficiency in the bleeder line."

L. N. Siler's solution included suggestions similar to those already presented but also made another one. Quoting from his letter, "In the event that Our Hero cannot extract steam from his turbine at a higher pressure, i.e., 75 lb or better, abandon the extraction of steam entirely and take steam to the factory at 250 lb. At this pressure there would be less line loss. Reduce the pressure to 75 lb at the factory end of the 600-ft line for the 75 lb stills and purchase a new reducing valve for the 75 to 20 lb service."

Julian P. Calvert who is a frequent contributor to this department was brief but very much to the point in his comments on the problem. "The best method," he says, "for putting into immediate service both batteries of stills and to operate them simultaneously on the existing steam piping system is to eliminate the 20 psi bleed line from the turbine. Change the setting of the present reducing valve in the power plant to reduce the 250 lb steam to 75 lb. Note the following installations in the factory building. On the supply line to old (20 psi) stills install a reducing valve to reduce the 75 psi steam pressure to 20 psi. On the supply line to the new (75 psi) stills install a desuperheater to reduce the steam temperature to the required 340 F."

Production of 100,000,000 Volt X-rays

THE RESEARCH LABORATORY of the General Electric Company at Schenectady, N. Y., announced recently that they succeeded recently in producing 100,000,000 volt x-rays for the first time in history. This so far surpasses anything of this kind that has ever been done before that it constitutes an achievement of the highest order and of the greatest importance.

These x-rays were obtained from the large induction electron accelerator recently completed. The characteristics of this new type of radiation will be published as fast as they can be determined but the first few observations show that these characteristics differ radically from those with which physicists are now familiar.

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LETTERS AND COMMENTS

To Bill From Bill About Bill—

IN ANSWER to Bill Heiweg about the question on whether he should renew his subscription to POWER PLANT ENGINEERING, I can't see where the paper has anything to do with your position in life. I can understand how you feel and can't blame you for the feeling but the love of operation of equipment in power plants will always stay with you because if you didn't have the love for these things, why did you study for them? No, it isn't that you will lose the love for this equipment, B. H., but it is the management that you have lost all your respect for and the only thing you can blame it on is the trade of engineering.

I would like to mention the case of a particular friend of mine. He is an A-1 all around machinist, can handle power plant equipment with some of the best and has done plenty of studying a certain amount of time every day. Still, when a certain brewery went out of business he went also; he was a far better man than the chief when the place was running but he refused to play politics with any party for a better job. But the job he now has is his first love, Machinist, and he is an instructor in one of the eastern vocational schools. He has told me from time to time he still visits power plants and he's over the 50 yr mark. He was one of the very first engineers to assist me in making acquaintances with other fellow engineers and to join the NAPE where I have spent and continue to spend many a happy and educational hour. Although some drift away for a time to work in the ship yards, defense plants, or go out on the road or back to the sea in ships, many return to the responsibility, grease and soot of the power plant to teach some of the new fellows right from wrong and why, just as B. H. probably has done many times in years past.

I don't believe B. H. meant to say, "to earn more, complain more." Bill was hot under the collar probably from taking such a kicking on the particular job he mentioned.

Bill's reference to the boss' failure to mention a job well done is an experience most of us are familiar with but we cannot be too thin skinned about it. When we were hired, we accepted for a certain salary to do so many hours of work and this work to be the best of our ability, so all taken into consideration, it's an exchange for a steady position, steady income and for the work we like best to do.

I've felt often the same as Bill has, and when I get that feeling I look around for something better, but every job has its fault and for me, I'm in the game that's in my blood. If Bill Heiwig will read the article by Bill Green in the July issue he will probably recall his first day in the boiler and engine room of his first power plant job.

What I can gather from Bill Heiwig's article is that now there is so much money around and men so scarce that inexperienced men are making big money, and Bill knows they don't have or ever will have the ability to handle even a small power plant properly. It gets under any good engineer's skin to see some of these palookas getting so much money for so little ability.

But Bill must think of some of the good young engineers who are in the Armed Forces, not getting the money, nor time off when they want it, and the distant places in which they are stationed and the fact while in the service there is no 40 hr week with time and half for overtime. So let's put up with whatever help we have and hope for better luck and Victory, instead of financial gain. Without Victory, financial gain will be worthless.

Let's put our shoulder to the wheel, smile and get this war over, for the sake of fellows like Pvt. Bill Green whose Dad would give every dollar he could get hold of if it would end this war and bring his son back safe.

Holding a Chief Engineer's license in a large industrial power plant was enough but to have held it for 23 years is quite an accomplishment, and I wish Bill Heiwig lots of luck and hope before long to hear that he is back in power plant work with a better job and with better management.

Philadelphia, Pa. WILLIAM T. MULLEN

Grossly Inefficient, Says He

IN YOUR September issue Mr. Harold S. Sykes expressed considerable doubt concerning a statement that his air-operated pump was grossly inefficient compared with one operated by an electric motor, and cited the almost universal use of air-operated auto lifts in refutation of such a statement.

Mr. Sykes may be interested to know that it can easily be shown that an air-operated lift is grossly inefficient compared with one operated by an electric motor.

The ordinary auto lift has a plunger about 10.5 in. in diameter with an area of 86.6 sq in., and a stroke of 4 ft, 6 in., giving a displacement of 2.71 cu ft. If the air-pressure in the cylinder of the lift reaches 150 lb per sq in. the air required is 29.8 cu ft of free air. The ordinary ¾ hp air compressor would require about 10 minutes to replace this amount of free air.

The actual power required to raise a 3000-lb car plus a lift platform or superstructure weighing approximately 1400 lb to a height of 4 ft, 6 in. in one minute would be 1.00 hp, assuming an overall mechanical efficiency of 60 per cent. A ¾-hp motor would accomplish the same task in 1.33 minutes.

Thus the relative efficiencies of the air-operated and motor-operated lifts are in the ratio of 1.33 to 10 of 1 to 7.5 under these conditions, although in actual use this ratio is subject to considerable variation.

This condition is widely recognized and many manufacturers have put on the market electrically operated lifts, some being purely mechanical and others being operated hydraulically by means of motor-driven pumps.

The relative inefficiency of the air-operated device cannot be denied, but in most cases other factors than efficiency must be given consideration, and may be controlling. Thus, where air-pressure is already available, the air-operated device usually can be installed for far less cost than the complete electrically operated device, and if the usage is relatively infrequent the saving in power is so small as to be more than offset by the increased investment. The fact that compressed air also povides a means for storing power is often a factor; for example, in the case cited the air-operated lift would raise a car in about 20 seconds, utilizing the air stored in the receiver, whereas a lift operated by a motor of the same size as that assumed for the compressor, viz., ¾-hp, would require about 1.33 min or 80 seconds.

Where the application is suitable, the use of compressed air can always be justified in spite of its low efficiency, because of its other advantages.

Upper Darby, Pa. HARRY R. TEAR

Charging Through Compressors

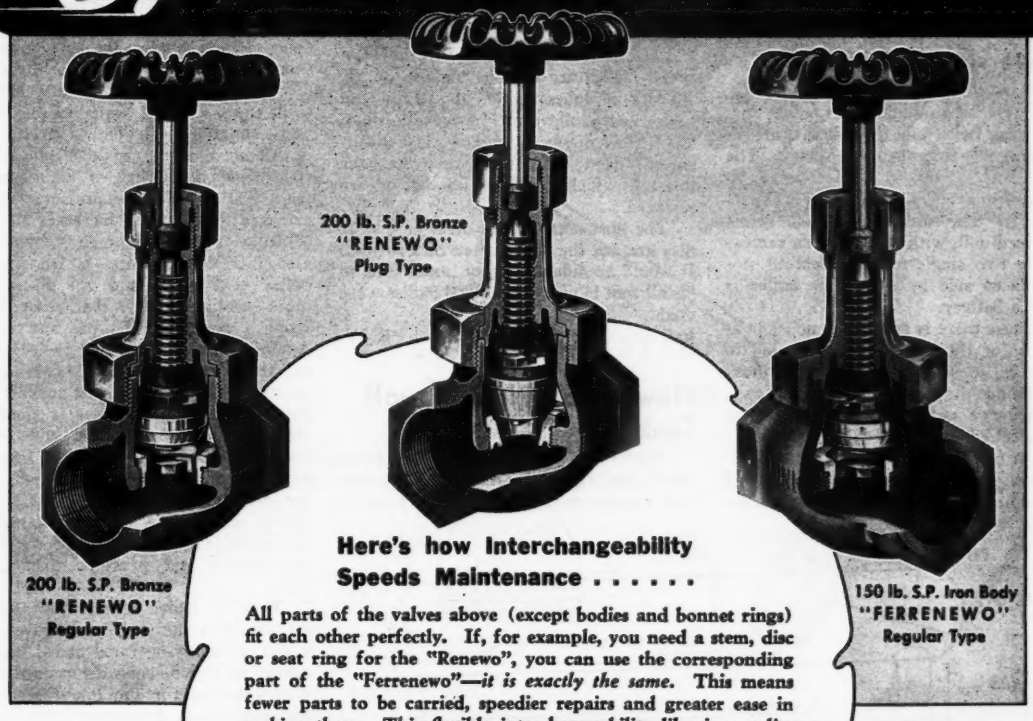
SOME TIME AGO, in an issue of POWER PLANT ENGINEERING, O. W. Malarkey, quite properly, pointed out the danger of charging refrigeration systems through compressors. What he says about this practice is perfectly true, yet we do it right along.

In our return lines is a big receiver. The compressor suction is taken off the top. It has a gage glass on it and is amply large. Our charging line is quite a long distance from this receiver and it is for that reason that we get away with the practice that Mr. Malarkey condemns. As we only dump in one drum at a time and we do this not very often we are quite safe. If we were to charge at a point close to the big valve it would take a long time to pump back and with sharp freezers this is important. In our brine cooler we keep the shell well filled and boil it off by regulation of the return line shut off valve to suit the brine temperature. This may sound goofy but I would like to see any one run this particular plant any other way and get results.

ROBERT BAKER

Simplicity of Design Means Easier Maintenance

INTERCHANGEABILITY Speeds Maintenance . . .



Here's how Interchangeability Speeds Maintenance . . . . . .

All parts of the valves above (except bodies and bonnet rings) fit each other perfectly. If, for example, you need a stem, disc or seat ring for the "Renewo", you can use the corresponding part of the "Ferrenewo"—*it is exactly the same.* This means fewer parts to be carried, speedier repairs and greater ease in making them. This flexible interchangeability likewise applies between the various 300 lb. S.P. "Renewo" Valves.

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With regular checking and inspection of this vital equipment and prompt servicing when necessary, valve life can be lengthened materially. It may save costly repairs later, and the possible shut-down of equipment.

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Questions And Answers

Question No. 240

Comments Wanted on This Oil-to-Stoker Conversion

WE ARE CONVERTING a 600-hp, box-header type longitudinal drum boiler, formerly fired with oil, to stoker firing as shown in the accompanying sketch. The boiler, rated at 600 bhp, has two longitudinal drums and 345 tubes, each 3½ in. by 18 ft. The stoker is a twin retort underfeed unit, with steam-driven rams—actually two single-retort underfeed stokers placed side by side. The boiler is one of a battery.

Because there is practically no room at the rear of the boiler, it is proposed to install a new motor-driven forced draft fan behind the bridge wall, as shown. The boiler is not expected to operate at more than 80 or 90 per cent of rating.

I do not think this proposed fan installation is sound engineering, because of the heating of the fan motor and other factors. I would like to submit the whole problem to POWER PLANT ENGINEERING'S readers for discussion.

The boiler has the conventional water legs and hollow staybolts as shown. Horizontal baffles are installed on top of the 5th row of tubes and on top of the top row. Soot is blown off the tubes through the hollow staybolts and is also steam-lanced through the same tube openings through which the 5th row baffles are replaced.

The horizontal baffles must be left as they are, for the boiler is one of a battery. It would be difficult, if not impossible, to install soot blowers if vertical baffles were used.

Fall River, Mass. R. W.

Answer No. 225

How Big Should a Blowoff Tank Be?

WHEN A. W. C., in the May issue, asked the above question, we referred him to two published statements on it. Here is a comment by George Holman.

Size Depends on Conditions

I WISH especially to call in question the use of the specified ratio (24 to 1) between the volume of the boilers and the volume of the tank. While it may serve as a rule of thumb against which to check more accurate figures, its outright use in the selection of a blowdown tank seems antiquated. Certainly it is impractical, if used without regard to other factors.

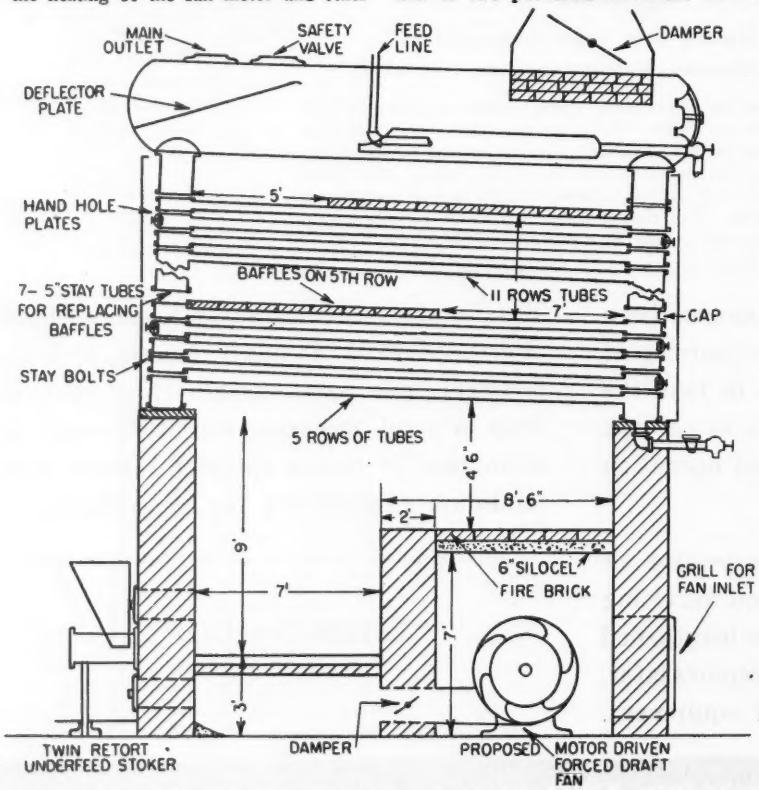
Type of boiler, boiler pressure, load, frequency of blowdown, duration of blowdown and the foaming or scale-forming characteristics of the water must be considered. Looked at from the viewpoint of the operator, the blowdown tank should be chosen primarily to fit the conditions of the plant, and only secondarily to fit the volume of water in the boilers to be simultaneously blown down.

As an example of the influence of conditions on the size of the blowdown tank, first consider the pressure. As the pressure in the boiler increases the temperature of the water being blown down also increases. Water blown from a boiler at 200 psi and 388 F requires more cooling water than that blown from a boiler at 100 psi and 327 F. Again, this depends on whether or not the excess heat is allowed to flash as steam up a vent to atmosphere before reaching the tank, as is commonly the case, or whether the end of the blowdown line is submerged. If flashing before cooling is permitted, less water for cooling would be required for the higher pressure. A higher percentage of the blowdown would flash at the higher temperature and pressure than at the lower.

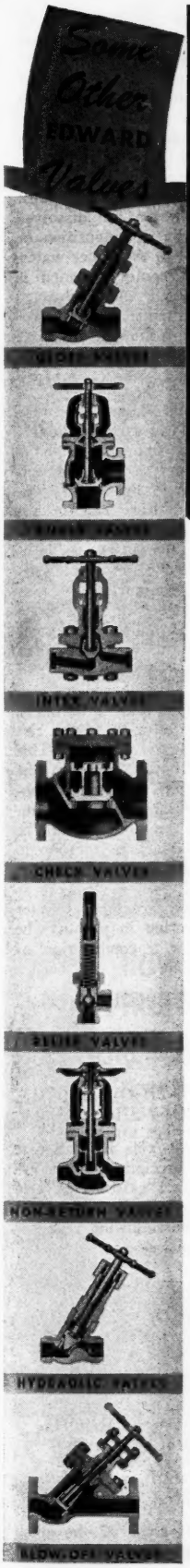
Type of boiler is important, as conditions about the plant are derived from it. In efficiently-operated plants, the frequency of blowdown is determined by the time required for the impurities in the water to reach dangerous scale-forming or foaming concentrations. This is also a factor of the load, quantity of water in the boiler and the initial quantity of impurities.

Since a fire-tube boiler contains three to five times as much water as a water-tube boiler of equal evaporating capacity, blowdown of the latter should be more frequent and of shorter duration. Of course, this affects the size of the blowdown tank needed. Because of the more infrequent and longer duration of blowdown of a fire-tube boiler, the tank for a boiler of this type should have at least three times the capacity of a tank for a water-tube boiler, other things being equal.

While impurities in water are the direct reason for blowdown, they are factors in the choice of a blowdown tank only in an indirect and sometimes surprising way. A boiler using feedwater containing 10 ppm scale-forming minerals may require as large a blowdown tank as one using water of 1000 ppm. But should either water contain substances which would require frequent blowdown of small quantities at a time, a much smaller blowdown tank would suffice. Where the chief impurity in feedwater is organic,



Cross-section of R.W.'s 600-hp, longitudinal drum boiler, as converted from oil to stoker-firing, showing proposed location of new forced draft fan because of lack of space at rear of boiler



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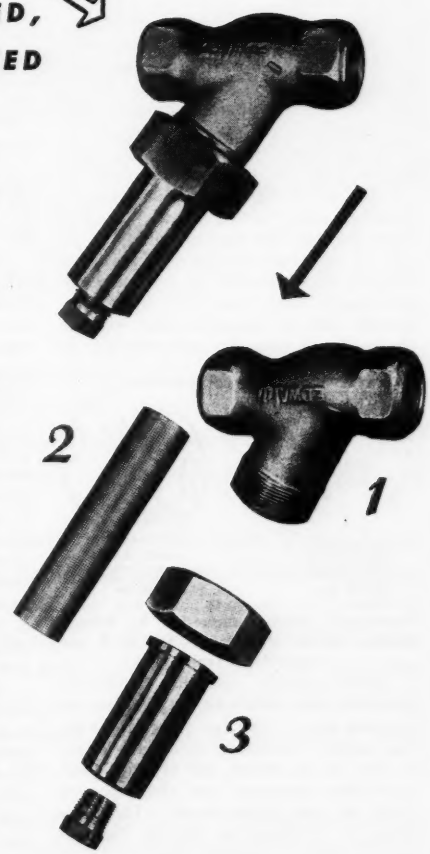

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necessitating frequent use of the skimmer, a blowdown tank the size of a barrel may suffice for a comparatively large boiler.

A fixed ratio for blowdown tank is like a clock that is stopped: right about twice every twenty-four times and wrong the rest of the time.

GEORGE HOLMAN

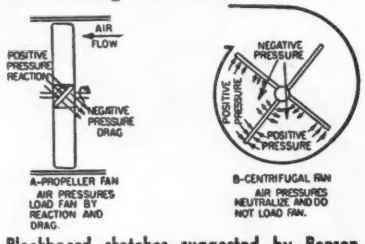
Answer No. 226

Why Do Fans Act This Way if Discharge Is Obstructed?

MALARKEY's desire for a simple explanation of the behavior of propeller and centrifugal type fans when intake or discharge is closed leads me to offer the following. The action of the propeller type fan in slowing down when the discharge is obstructed seems logical enough and what anyone would expect, but the apparently strange action of a centrifugal fan becoming unloaded and speeding up under the same conditions is difficult to understand.

Since it is change of load on a fan that affects the speed, we will find that on analyzing the load factors in the two types of fans that their action becomes clear and logical.

Considering first the propeller type fan, where load factors are really self-evident, we find there are two components loading the fan. As the air is forced ahead by the screw action of the blades it is apparent, as shown in the sketch at A, we have the reaction of the positive pressure on the discharge side of the fan acting against the face of the blades as shown by the arrow. Likewise there is a negative pressure drag on the rear of the blades on the intake side of the fan, also indicated by arrows. Note particularly that these two load components act on opposite sides of the blades, hence may act independently to cause loading of the fan.



Blackboard sketches suggested by Benson, showing action of propeller fan at A and centrifugal fan at B

Under normal operating conditions, there is little difference in pressures on the two sides of the fan so normal loading results. However, should the intake of the fan be closed, the negative pressure drag increases and thus the fan loads up and slows down. The same effect is obtained by closing the discharge, since a positive pressure builds up and the reaction on the fan increases the load and the fan slows down. From the above it should be clear that it is variations in pressure that causes changes in the fan speed.

On the other hand it will be found that changes in pressure have no effect upon the loading of the centrifugal type fan as we shall shortly see.

Referring again to the sketch at B, as the air is whirled in the pockets of the centrifugal fan, the pressure is built up in the outer areas of the pockets due to centrifugal force. This pressure causes the discharge of the air from the fan but it has no reaction on the blades because it acts outwards and equally towards the face of one blade and the rear of the other as indicated by the arrows. It is obvious that the pressures balance out as far as their effect on the fan is concerned. This holds true for the areas of low pressure near the center of the fan where any negative pressure drag also balances out as shown by the arrows.

Since pressures have no effect on fan loading, we must look elsewhere for the load factor. We find it is the work done in bringing a relatively still body of air to a high rotative speed almost instantly. In other words the load on the fan is simply one of overcoming inertia of air. Therefore, the more air the fan handles in given time, the more work it must do; conversely, if the amount of air handled by the fan is decreased, the load decreases.

And that is all there is to the centrifugal fan speeding up when the intake or discharge is closed. The fan simply is not passing any air and the fan has no work to do except to overcome the friction of the air in the scroll.

Philadelphia, Pa. THOS. W. BENSON

Answer No. 236

Why the Difference in pH in These Two Boilers?

WHAT WOULD cause the water in two different boilers to vary in alkalinity and hardness, when they deliver steam at the same pressure and temperature to a common header and take feedwater from a common source? asked H.E. in the September issue.

One unit is a 140-hp Scotch type operated at about 270 Bhp. The other is a 315-hp bent-tube 3-drum unit, operated normally at about 350 Bhp. The Scotch boiler, over a given period, tends to build up its alkalinity from pH 9.6 to pH 11.0 or higher, while the hardness decreases from 0.4 grains per gal to neutral. In the same period the bent-tube boiler not only maintains a pH of 9.8 but also decreases to 9.4 in a few weeks; its hardness increases from 0.4 grains per gal to 3 grains or more.

Each boiler receives the same feedwater from the same feed pumps and heater and in the same proportion of return condensate to soft makeup. By close control and individual treatment, of different composition for each boiler, the pH in both boilers is kept at pH 11.0, says H.E., but this does not explain to him their dissimilar tendencies.

Stransky Analyzes the Possible Chemical Reactions

NOT KNOWING the type of raw feedwater, softening, and conditioning treatment, boiler pressure or temperature a definite answer to this question is more or less impossible. However, here is a possible cause of the rise in the pH on the Scotch type boiler with a decrease in hardness.

In the Scotch type boiler, because of operating at approximately 200 per cent rated capacity, it is possible that localized high temperatures or superheat conditions are obtained on the water side of the tubes in the pass nearest the fire. Assuming this to be true, we now must analyze the boiler water for dissolved solids which could by decomposition or reaction raise the pH of the boiler water. The main one that comes to mind is sodium carbonate which, when subjected to high pressure and temperature, hydrolizes according to the following reaction:

$$Na_2CO_3 + H_2O \rightarrow 2Na\,OH + CO_2$$

The formation of the sodium hydroxide raises the pH. The carbon dioxide stays in the gaseous state and tends to promote corrosion in the prime mover, condenser, low-pressure lines, etc. The existence of sodium carbonate in the treated feedwater can be explained as arising from several causes such as treatment of carbonate and/or bicarbonate water with sodium zeolite, excess from soda treatment, or from direct addition of soda to maintain a given carbonate-sulphate ratio to prevent embrittlement.

The hydrolyzing of the sodium carbonate also shows a decrease in hardness, using standard soap solution, if the rise in pH is not taken into account. This can be explained by the fact that the standard soap solution end point is obtained at a relatively high pH. Therefore, standard soap solution will not be required to raise the pH in addition to precipitating the calcium and magnesium in the sample.

In the bent-tube, three-drum, water tube boiler the lowering in pH may be attributed to one or a combination of the following reactions:

$$Mg\,Cl_2 + 2H_2O \rightarrow Mg(OH)_2 + 2HCl$$

$$2\,NaCl + Mg\,SO_4 + 2H_2O \rightarrow Mg(OH)_2 + Na_2SO_4 + 2HCl$$

$$2\,NaCl + Mg\,CO_3 + 2H_2O \rightarrow Mg(OH)_2 + Na_2CO_3 + 2HCl$$

The magnesium hydroxide in each case forms a flocculent precipitate. The hydrochloric acid cannot exist as an acid in a basic water (pH above 7). One or a combination of the following reactions can then take place:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

$$2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$$

$$2HCl + Fe \rightarrow FeCl_2 + H_2$$

$$Fe\,Cl_2 + Mg(OH)_2 \rightarrow Fe(OH)_2 + MgCl_2$$

$$\text{or } Fe\,Cl_2 + 2NaOH \rightarrow Fe(OH)_2 + 2NaCl$$

The neutralizing of some of the alkali in the water by the hydrochloric acid

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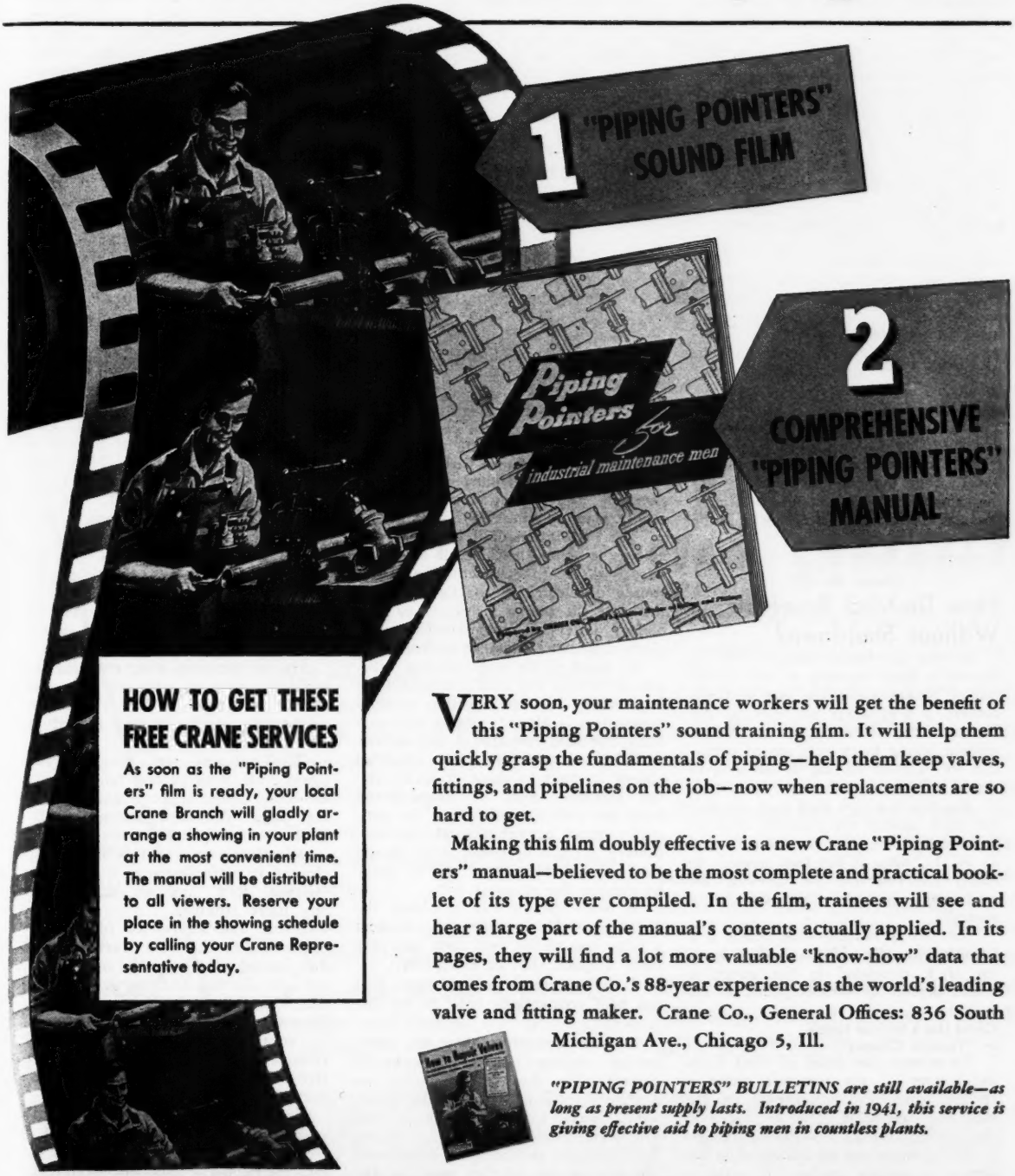

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then lowers the pH. As can also be seen, corrosion is promoted due to the action of hydrochloric acid on iron. The final products of this series of reactions are the same as the initial products so the cycle is continuous.

The fact that the pH was lowered only 0.4 over a prolonged period of steaming indicates that these reactions do not take place to a very appreciable extent. These same reactions could take place in the Scotch type boilers; however, a rise in pH indicates a predominance of sodium carbonate hydrolysis over the chloride and corrosion reactions. These reactions (chloride and corrosion) do not indicate an increase in hardness in the bent-tube boiler, which leads me to believe that the gain in hardness is due to the concentrating effect of the boiler and insufficient blowdown.

Sunnyvale, Calif. M. W. STRANSKY

Balanced Boiler Load Will Help, Says Keas

IF YOU WILL do these things you will have no more trouble with the boiler water. Carry the heater temperature at 212 F in an open type heater. Balance the boiler load on each boiler as to capacity. Check the blowdown and water column for leaks. Your alkalinity is controlled by the makeup, blowdown, boiler compound, and the amount of load you are pulling. I noticed you are pulling the Scotch boiler much heavier, thus the alkalinity and the soluble salts concentration will rise much faster in this boiler, while the other boiler, if it has the same blowdown, will lose alkalinity, because the latter is not being built up as fast.

Leavenworth, Kans. D. M. KEAS

Answer No. 237

How De-Mud Reservoir Without Shutdown?

IN THE SEPTEMBER issue, L. W. L. showed a detail drawing of one of his cooling towers and asked how he could remove a 6-in. layer of mud on the bottom of the reservoir under the towers, without taking the towers out of operation and without stirring up the mud so that it will circulate through the system.

The mud is a soft, fluid mud. It does not pack against the concrete floor of the reservoir. On occasions, says L. W. L., when it has been possible to empty the reservoir for cleaning, the mud could be easily removed by a squeegee.

But this is exactly what makes it a problem to handle without shutting down, for if it circulated in the water, it would deposit at various points in the system.

Could Use a Suction Nozzle or "Vacuum Cleaner"

TO REMOVE the layer of mud from the bottom of the reservoir under a cooling tower without stirring up the mud and causing it to be circulated in the cooling system, it seems as though L. W. L. might use something along the idea of a suction dredge. If pressure water is available, suction could be created by a syphon and the water thus used would be a help in washing the mud down the sewer. If no pressure water is available a centrifugal pump could be used.

The size would depend mostly on the speed with which the job must be done. I would suggest a 4-in. suction line, with a sheet metal nozzle flared out to an opening approximately 1 in. wide and 2 ft long. The 25-ft width of the reservoir would be hard to reach from only one side, but the "vacuum cleaner" could be mounted on wheels, or a smaller rig used.

Such a rig would, of course, take some water from the cooling system to make the mud fluid and carry it off, but no shutdown would be necessary while using it.

Montpelier, Vt. J. S. M.

Answer No. 238

Why Electricians Chew Their Fingernails

THEY DON'T USUALLY chew 'em way down past the elbow, the way the Venus of Milo did—but it gets pretty bad sometimes. There were two separate problems under the above heading in the October issue: a, What is the best way to build up the lost residual magnetism of a generator, and can it be done without disturbing connections; b, How clean out the cooling coils of a transformer that is running hot and keep them clean?

Outside Current to Build Up Residual, Sal Soda to Clean Transformer Coils

a. LOSS OF THE residual magnetism is certainly an amazing factor for the power plant engineer in question 238.

The restoration of it is not as difcult as it seems, because all M. J. N. has to do is to connect an external source of electricity to the field. In this case the use of a primary or secondary battery is recommended. The electric pressure must be at least 6 v.

To build up the magnetic flux without disturbing the field connections is impossible, because, if the residual magnetism is absent, closing or operating the field rheostat is impractical.

When connecting the external source it must be done in series and the machine must be disconnected from the switchboard. Also the generator must be running at the customary speed. Frequent tests, should ½ hour be spent, have to be made by closing the rheostat fully.

A more speedy way to obtain the necessary field strength is to connect a 110-v line to the field coils and give them a quick shot of electricity.

It is imperative in both cases that the field connections have to be disturbed.

b. Your assumption about the transformer cooling coil is undoubtedly correct. To clean it, I would use a strong solution of sal soda, which would have to be introduced into the water stream by some means. But as soon as the heat diminishes, the flow of the solution must be discontinued. This cleaning could be a temporary relief only. To be on the safe side a chemical analysis is needed. The result of this test would determine what kind of water softener to use in order to keep the coils clean.

Camp Ellis, Ill. CARL EGERTER

Perhaps the Residual Isn't Lost; Perhaps It's Something Else, Says Baker, With Evidence

a. M. J. N. may restore his residual magnetism by lifting his brushes and applying direct current directly to the field coils. This may be done safely with about 10 per cent of the machine's rated voltage, without using a field discharge switch and resistor.

We once had a machine giving a lot of trouble in this respect, which we restored with an old 6-v storage battery. We kept the old storage battery around for years just for that purpose.

We had a recent problem on a small motor generator set which has led me to wonder if the loss of residual magnetism is as common as thought. That is, aren't a lot of troubles which develop blamed on this loss of magnetism whereas the cause really is something else?

An example of what I mean is as follows:

The small generator serving our magnetic separator or pulley would for no apparent reason fail to build up. We would take the generator apart, clean the commutator, all the field coils, brush holder and, last, apply 6 v from a hot-shot battery to the field. The cleaning didn't hurt the generator nor were we of the opinion that it really helped. We just did it because coal dust made it look bad.

We were of the opinion that the application of the 6 v to the field did the trick. This failure to build up got to be such a nuisance that we finally decided to see just what caused the trouble.

One of the boys, after studying the problem, came up with the idea that maybe the machine didn't lose its magnetism, maybe it was something else.

The outcome was that we just cleaned off, with carbon tetrachloride, the brush holder supports and supporting ring. We then started up the generator and it built up fine.

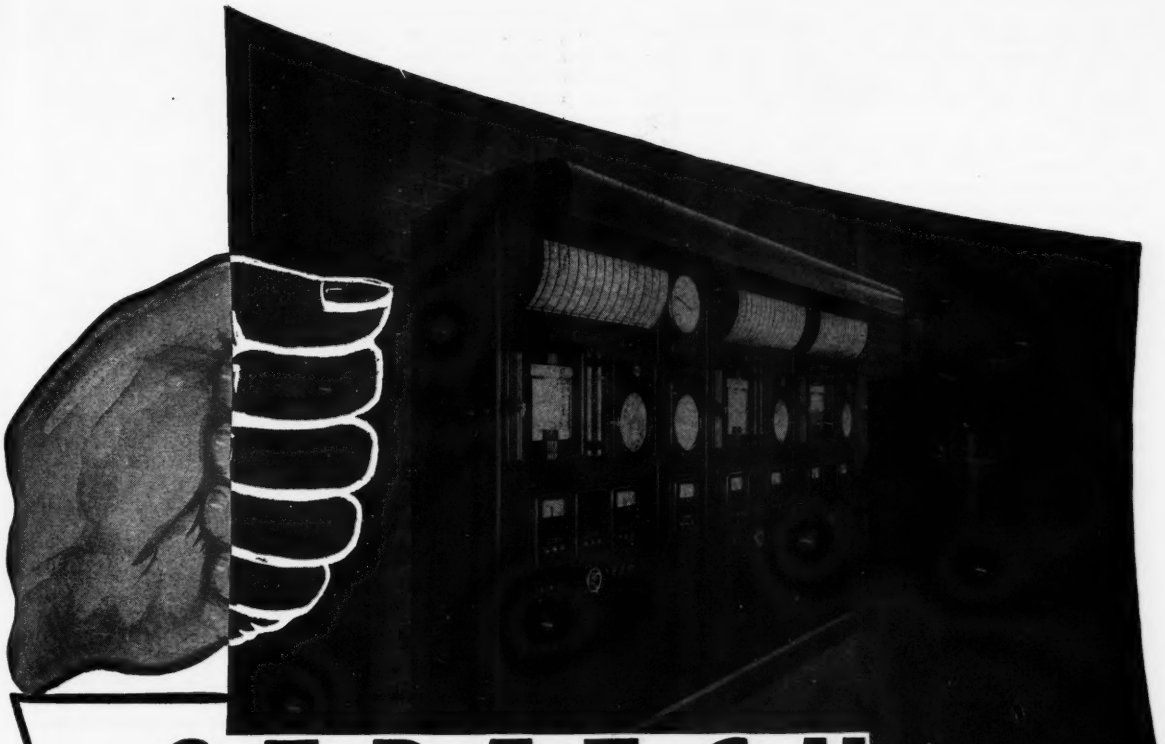
We then removed the brush ring, cleaned it perfectly, gave it a coat of "Glyptal Red" and we haven't had any more trouble.

From the above we formed the opinion that the coal dust, oil and dirt formed a path for the initial small voltage, shorting out the generator so that it could not build up. The path formed by the coal dust, dirt, etc., must of course have a resistance high enough to prevent any noticeable difference in operation when running normally.

I wonder if the above couldn't be some of M. J. N.'s trouble?

If all of his field resistance is cut out, the field will build up faster if it's going to build up at all.

b. The second part of the question, concerning the transformer cooler, leads me to believe the coil is of the



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"corkscrew type" which can't be cleaned by pushing something through it. If it is of this type and can be removed the best way of cleaning is by cracking.

We clean our oil cooler each year by removing it from its shell, blowing live steam through it (don't stop it up) until the surface oil on the tube or copper coils starts to smell and smoke. We then shut off the steam and throw cold water on the tubes. When the steam is again turned on, the dust flies.

If the cooler is very dirty, I'd suggest that the first time cracking is tried, the temperature should be held down to prevent too much loosening of material which might stop up the cooler completely.

Also, after cleaning the cooler, steam should be applied to the water side long enough to evaporate all moisture from the oil side of the cooling coil. The coil can then be placed back in its shell, preferably before it cools down to room temperature.

There is only one way to keep this cooler clean and that is to treat the water going through it. It is usually much cheaper, if this is the only cooling problem, to clean the cooler occasionally by cracking.

Clearwater, S. C. R. C. BAKER

Answer No. 239

Where Does the Engine Get All the Btu's?

WHEN J. D. G. asked this question, published in the October issue, he was thinking about his engine-generator set that consumes 40 lb per kwhr of 125 psi gage throttle steam, exhausting at 5.2 psi gage. Taking the enthalpy of the steam at each condition, he said the engine only extracted 37 Btu from each pound and 37 × 40 = 1480 Btu—but there's 3413 Btu in a kilowatthour! Where did the additional heat units come from?

Of course he forgot that—well, it could be either of two things, as pointed out below:

Calculations of Exhaust Conditions Reveal Missing Btu's

WE WILL FIND the missing Btu's if we subtract the total heat in the steam "leaving" the engine from the total heat in the steam "entering" the engine, then the exhaust steam will not contain 1156 Btu per lb as given in the question. When taking into consideration the total heat in the steam entering, with the given steam rate, this will be shown as follows. There are only two ways in which heat is abstracted from the steam in passing through the engine.

1. By conversion of a part of the heat into work.

2. By heat lost through cylinder radiation.

The heat equivalent of one kwhr = 3415 Btu. If we assume the radiation loss to be 10 per cent of the heat converted to work, then the heat taken from the steam by the production of one kwhr is 3415 divided by 0.9 = 3795 in round figures. With a steam rate of 40 lb per kwhr, the heat taken from one pound of steam is 3795 divided by 40 = 95 Btu. The total heat in the steam (assuming dry saturated steam) at 125 lb psi gage is 1195 Btu per lb entering the engine. Since 95 Btu were taken from each pound of steam passing through the engine, the heat in the steam leaving the engine must be 1193 — 95 = 1098 Btu per lb; this is exhausted at 5.2 psi gage.

From the steam table the total heat of dry saturated steam at 5.2 psi gage is 1156 Btu per lb, the latent heat is 960 Btu and the heat of the liquid is 196 Btu. The heat of the liquid must be the same in either case, so the difference in the total heat—1098 in the exhaust leaving engine and dry saturated steam at the same pressure—must be due to the difference in latent heat; subtracting 196 from 1098 leaves 902 Btu remaining as latent heat. As the latent heat of dry saturated steam at 5.2 psi gage is 960 Btu, the quality of the exhaust is 902 divided by 960 = 0.9395 or 93.95 per cent, or stated another way, the steam contains 6.05 per cent moisture leaving the engine, instead of being dry saturated steam, which is indicated in the question if the exhaust steam contained 1156 Btu per lb. St. Paul, Minn. ENOCH B. STROMBERG

Editor's Note—Another way of figuring the quality in the exhaust is by the formula

$$H = q + X L$$

in which H = enthalpy of exhaust steam (total heat); q = enthalpy of the liquid; X = quality of the steam as a decimal; L = enthalpy of evaporation.

Then 1098 = 196 + X960, from which X = 0.939 or 93.9 per cent or the exhaust contains 6.1 per cent moisture. It is from the heat given up by this 6 per cent of the steam in condensing to moisture at 5.2 psi gage or 20 psi abs that additional Btu's are drawn. To turn the water into steam at 20 psi, we would have to add 960 Btu per lb to it, so in condensing from steam to water again, it must give up 960 Btu per lb. Now if only 6 per cent of a pound condenses to water it will give up 57.6 Btu, which is added to the 37 Btu it gave up in expanding from 140 psi abs to dry saturated steam at 20 psi abs.

Missing Btu's Could Come From Superheat in 125 Psi Throttle Steam

In answering this question, we will try to deal with fundamentals, neglecting heat losses from radiation and friction and assume the equipment is 100 per cent efficient.

According to the first law of the science of thermodynamics: whenever heat energy is transformed into any other kind of energy, or vice versa, the quantity of energy which disappears in one form is exactly equivalent to the quantity which is produced in the other form.

After checking the information given by J. D. G., we find that 3415 Btu are to be converted into kinetic energy of water vapor, and then into mechanical energy in the steam engine, and then into the electrical energy of one kilowatthour in the generator. And this energy to be extracted from 40 lb of steam.

The following table gives the physical condition of the steam as stated in the problem.

	At Engine Throttle	At Engine Exhaust
Pressure gage	125 psi	5.2 psi
Temperature F	?	?
Btu content	1193 Btu	1156 Btu

We believe J.D.G. actually found these conditions existing, but we question the 1193 Btu at the engine throttle. Let us carefully examine the definition of a British thermal unit. Most engineers accept this version: 1/180th of the heat required to raise one pound (avdp) of water from 32 F to 212 F, at the atmospheric pressure of 14.7 psi. Now we find two conditions upon which depends the value of the Btu content: the pressure and the temperature. We have the pressures given in the table so the Btu's would vary as the temperature.

Our steam table, having two unknown quantities, and one questionable, we shall attempt to fill in these figures without resorting to any complicated mathematics.

We have 3415 Btu of available energy in 40 lb of steam, and, as our table is given in values of one pound of steam, we divide 3415 by 40 and get about 85 Btu's.

The exhaust pressure is 5.2 lb and as this steam is being utilized, the lowest possible temperature that it could leave the engine without condensing would be the saturation temperature of 227 F. This compares favorably with the 1156 Btu's in the steam as it leaves the engine.

The engine loss which we assumed to be 0 plus the energy converted (85 Btu) plus the Btu in the exhaust steam (1156) would give us the Btu content of the steam entering the throttle (1241).

Referring to a table of the properties of superheated steam, we find that a pound of steam having 1241 Btu's at a pressure of 125 lb gage would have a temperature around 440 F.

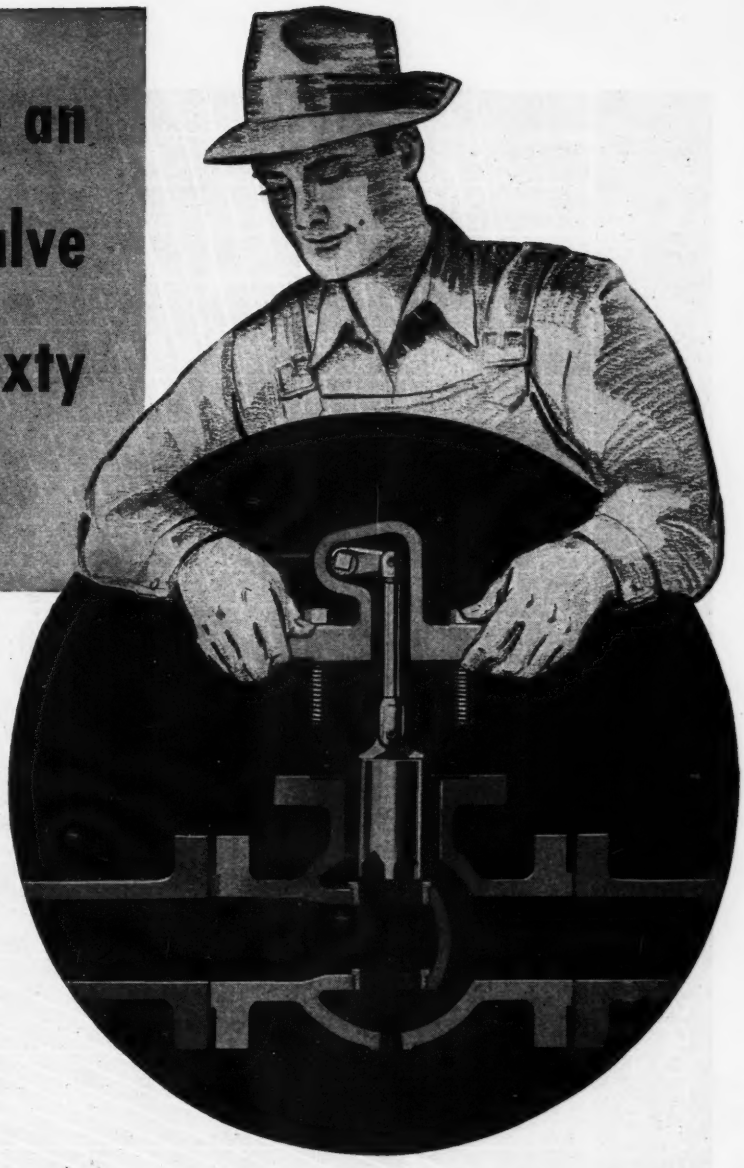
Now to answer J.D.G.'s question, "Where did the extra Btu's come from?" we make this observation: They came out of the coal in the boiler. When J.D.G. consulted his steam tables, he was misled by assuming the saturation temperature 353 F, at 125 lb gage pressure, was the temperature of the steam entering the admission valves of his engine.

Thermometers placed in the steam header and the exhaust line would be more convincing proof than all the fancy thermodynamic formulas and tables.

Chicago, Illinois WALTER HEIDECKER

Editor's Note—In his original question, J. D. G. did not say where his 125-psi throttle steam comes from. If his boilers generate at 125 psi gage, he might or might not get the amount of superheat Mr. Heidecker calculates—no mention is made of superheaters. On the other hand, suppose the engine is drawing steam from a high-pressure, high-temperature header through a reducing valve. It could easily be superheated the amount Mr. Heidecker calculates.

How to Make an Old COPES Valve Like New in Sixty Minutes



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Here is a handy chart showing factors of evaporation. It is presented here by courtesy of the Babcock & Wilcox Co. from whose bulletin on Marine Boilers it is abstracted.

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In one instance, the diesel supplying power for a giant stone crusher had been lubricated by three nationally-known, high-quality diesel oils. With each of these oils, excessive hard carbon and gum deposits caused sticking rings and loss of power. Every time the engine was overhauled, it was necessary to *break* the rings to free them, resulting in high annual replacement costs.

After changing to SOLNUS Heavy for summer service and SOLNUS Heavy Medium for winter, carbon deposit was very slight and that which did form was so soft that it could be wiped away with a cloth. All piston rings (even the top rings) were free . . . and costs for replacement of parts were the lowest ever experienced.

This field report is typical of the many which we receive every year. It suggests that SUN Lubricants and SUN Engineers . . . those capable "Doctors of Industry". . . may be able to help you solve your difficult lubrication problems. Write to . . .

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(*Continued from Page* 84)

Fig. 4. Chiselled surface of runner

Fig. 5. Surface of runner smoothed by milling

ods used on similar repair jobs were studied and some good suggestions were obtained, but the program was much larger and differed in many respects. Time did not allow much experimentation or testing.

A wood staging was so constructed that it could be readily installed through the draft tube inspection doors and yet not sacrifice any strength. The platform was set at an elevation so that the men could conveniently work on the vanes and still have complete access to the inspection doors in case of an emergency. Foot benches in varying heights were used for the convenience of both tall and short men. Drawing Fig. 3 shows details of the platform.

Portable power switchboards, drop cords, welding leads, grounding cables and other miscellaneous wiring were installed. A master switch was installed in the draft tube, Fig. 3, so that ventilation and welding machines could be shut down in case of fire or other emergency. Considerable thought was given to making the ground connections for welding operations. In order to prevent a heavy flow of current from the turbine shaft to the guide bearings, the runner and draft tube were both grounded with 500,000 cm cable. A ¼ in. by 2 in. mild steel strap was also welded between the runner and discharge ring. The grounding cables and other wires were passed in under the platform and up through holes in the center of the platform, under the runner cone. The master switch was attached to the runner cone where it could be conveniently reached.

Chipping and Milling Methods

The chipping methods were much the same as those used at the Safe Harbor Plant of the Safe Harbor Water Power Corp. Round nose chisels ¼ in. to ½ in. were used to make parallel cuts ½ in. to 1 in. apart through the pitted areas, Fig. 4. The cuts were uniform in depth and were used as a gage for removing the remainder of the cavitated metal. It was found that the depth of cut could be controlled more closely with a round nose chisel than with a cape chisel. The areas between the ½-in. furrows were then chipped out with the use of ½-in. to 1-in. flat and cape chisels. The cavitated metal was completely removed and all areas were chipped down to sound parent metal.

During the repair work, a milling machine was developed. The machine was built and tried out on Unit N-4. The possibilities of such a machine became apparent and it was developed so that very successful operation was obtained. The milling head was driven by an air motor and was constructed with an adjustable feed for accurate rapid adjustment to depth of cuts and to release the milling cutter in an emergency. Cuts are made in even steps, approximately ⅛ in. deep, so that successive welding layers can be laid on uniformly. Small sections of cavitated metal, which still existed after the milling operation, were chipped out to sound parent metal.

The primary object of the milling machine was to get an even surface, Fig. 5, on which to build up successive layers of welding. This objective was attained, and, in addition it was found that the metal could be removed in 0.04 man hours per square inch as compared with 0.06 to 0.08 man hours per square inch by chipping.

In addition to the above saving, the smooth surface was conducive to better welding and subsequently faster grinding.

Dials and Trams Used

Two dial indicators were also placed, 90 deg apart, on the runner vane tips and feeler gage readings were taken at four points, 90 deg apart, to obtain the clearance between stationary and runner wearing rings. At first, these readings were taken every half hour, but as it became apparent that there would be no distortion, readings were recorded once every hour. The dial indicators showed 0.001 to 0.002 in. variation. This, however, was not considered the result of welding because the change coincided with a change in scroll case temperature as the penstock was being filled. Feeler gage measurements were averaged by adding diametrically opposite readings. Then, if the runner became distorted, the change in readings along one axis would show a corresponding change along the other axis. Measurements varied somewhat with the different men taking readings; however, careful scrutiny of the figures disclosed a maximum probable movement of not more than 0.002 in.

Tram marks were made on the lower flange face of the runner cone and on the center trailing edge of each vane. The marks were made the length of a tram, about 3 ft long, which was used to check the distance between the vanes and runner cone so that warping, if any, could be detected. Later, the long tram was discarded and a shorter tram, about 5 in. long was used to check the distance from one vane edge to the adjacent vane in about the same place that the struts were previously located. The measurements at this point, using the short tram, showed an average maximum deflection of 0.025 in.

Welding Rods

Unit N-1 was repaired with an austenitic 18-8 (18 per cent chromium, 8 per cent nickel) stainless steel coated rod, having 0.07 maximum carbon and a columbium to carbon ratio of not less than 10. No test samples were made and the tensile strength and ductility are not known. The stainless steel rod was laid on with a close overlapping bead and the metal gave a smooth, bright polish, after grinding operations.

NO. 10 OF A SERIES
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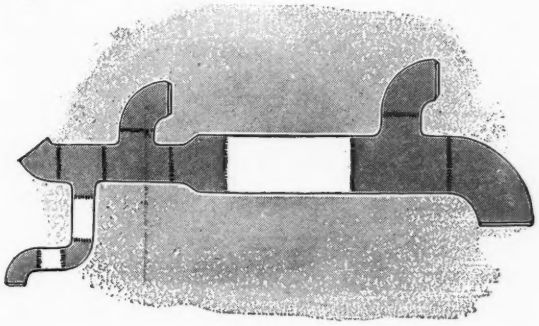
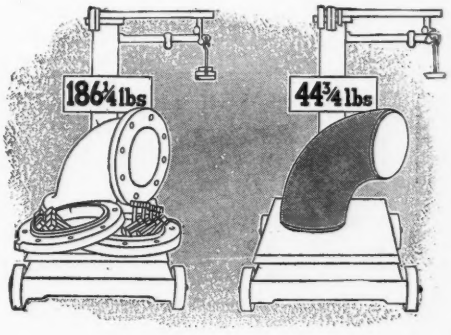


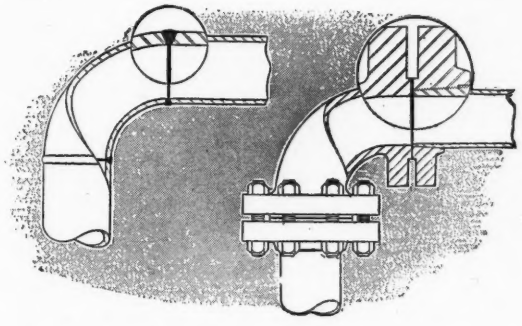
1. Easily preassembled—speed installation

Save from 50% to 75% time by pre-assembling difficult piping sections like this in the shop. Tube-Turn fittings are ready to use. They simplify lining-up, require only easy, circumferential butt welds. This insures faster, better and safer welding by either veteran or novice welders—a real war production help.



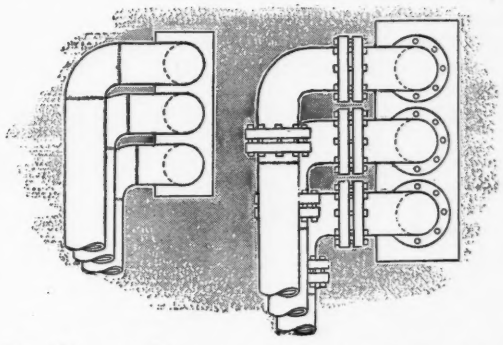
2. Reduce weight—conserve materials

Look at the weight saved by using an 8" Tube-Turn elbow instead of a heavy 8" cast iron flanged ell with companion flanges, studs and nuts. Multiply this saving by the many fittings in any piping system and it's easy to see how Tube-Turn fittings save tons of weight, metal and critical materials.



3. Avoid "down time"—reduce maintenance

Note how the welded connection virtually forms a continuous tube without joints—insures permanently leakproof, trouble-free connections that last as long as the pipe itself! Such maintenance headaches as leaks, gasket changes, bolt tightening, caulking, threading, and difficult insulatings are totally eliminated.



4. Streamline systems—save space

Contrast the space saved in these compound turns by using Tube-Turn elbows instead of flanges. Tube-Turn fittings require less space, permit streamlined, compact layouts and neater, more efficient piping. Elbows can be cut to any odd angle. Saving space is important in most industries, is vital in shipbuilding!

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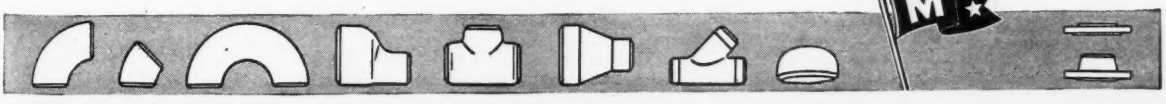


Before applying the stainless steel rod, all low spots and deeply chipped areas were built up with a mild steel rod. The welding beads were laid on horizontally, and all succeeding layers were applied parallel to the under-layers. After each layer of welding beads was laid on, the beads were carefully wire brushed and peened. The low areas were built up to

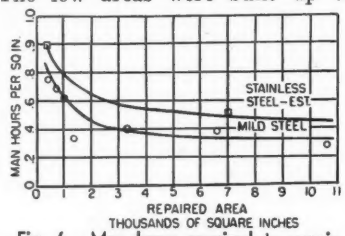


Fig. 6. Man hours required to repair surfaces

within not more than 0.1 in. of the final contour as determined by the templates. A minimum thickness of 0.1 in. was maintained for the stainless steel layer which was applied last.

A small amount of work hardening of the stainless 18-8 is shown by the fact that the Brinell hardness was approximately 200 to 210. The hardness was obtained with a portable Brinell set using a 5 mm ball and 750 kg pressure. The 18-8 rod was applied with reverse polarity, 90-95 amp and 27-30 v. Three sizes of 18-8 stainless steel rod were used: 5/32, 1/8 and 3/32 in. The 3/32 in. rod was used mainly for patching low areas during grinding operations. The amount of rod used is shown in Table I.

Units N-4, N-2 and N-3 were repaired with a mild steel rod, having approximately 0.14 carbon content, 70,000-80,000 psi tensile strength, and 20 per cent elongation in 2 in.

The mild steel rod was applied with straight polarity, 150 amp and 25-30 v. The method used was the same as that used on Unit N-1. In some areas where pitting was deep, as many as seven welding beads were necessary to build up some of the vanes to the original contour. The size of mild steel welding rod used was 5/32 in., 1/8 in., and a small amount of 3/16 in. The Brinell hardness was approximately 145-160, using a 5 mm ball and 750 kg pressure. This was

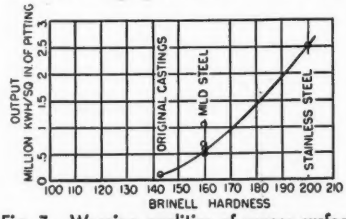


Fig. 7. Wearing qualities of runner surface with steels of varying hardness

approximately the same hardness as the parent metal.

On vane 15, Unit N-4, a special low chromium rod having 4 to 6 per cent chromium, a small amount of vanadium and molybdenum, and 0.10 to 0.18 carbon was used. The rod has a tensile strength of 100,000 psi and 12 per cent to 18 per

Fig 8. Appearance of original runner surface

cent elongation in 2 in. No tests, however, were made to determine actual characteristics. The rod was very difficult to apply and the welding time was higher than for the stainless steel and mild steel rods. Great care was taken to puddle the metal so that there would be no gas pockets or slag inclusions. The effect of air hardening was noticed. The Brinell hardness was approximately 205 and the surface was more difficult to grind than the stainless 18-8. The rod was applied with 150 amp and approximately 30 v and reverse polarity. This vane has been observed and the pitting resistance is no greater than the mild steel. The fact that the low chromium surface did not give a non-corroding finish was shown by the fact that vane 15, after two weeks' operation, could not be distinguished from the vanes which had been repaired with mild steel. All of the vanes had a uniform coating of oxide.

After each welding pass the beads were peened and wire brushed in the same manner as was done on Unit N-1. The mild steel peening, however, was much easier and faster than the stainless 18-8 surfaces.

Some cracks were experienced on the runners. They were found in the upper or lower fillet near the trailing edge of the vanes and in the band or lower shroud. The appearance of cracks caused considerable thought and discussion and resulted in testing all runners with Magnaflux method. The tests

(*Continued on Page* 122)

TABLE I. BOULDER POWER PLANT LABOR DISTRIBUTION ON CAVITATION REPAIRS

Unit	Date	Area Repaired Sq. In.	Man Hours	Man Hours Per Sq In.	Million KWH Per Man Hr	Welding Rod Lb	Lb Rod Per Sq In.
N-1	4-7-38	7,000	3,570	.51	.12	596	.085
N-4	5-15-38	10,600	2,930	.28	.15	1,175	.111
N-2	6-27-38	6,670	2,502	.38	.20	1,000	.150
N-3	8-14-38	3,300	1,266	.39	.35	350	.106
N-4	3-23-39	460	346	.75	.83	40	.087
N-4	7-29-40	1,000	612	.61	.81		
N-2	8-19-40	1,400	465	.33	1.74	250	.071
N-3	9-12-40	768	521	.68	1.53		
N-1	10-9-40	368	365	.99	2.52		
	TOTAL	31,566	12,577	.398		3,460	

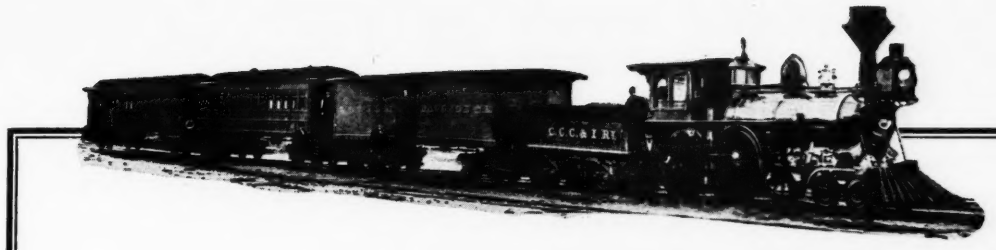
The 3,460 lb of welding rod included 2,735 lb of mild steel, 650 lb of 18-8 stainless steel, and 75 lb of 4-6 chromium welding rod.

TABLE II. BOULDER POWER PLANT LABOR DISTRIBUTION ON CAVITATION REPAIRS

Operation	Unit N-1 Man Hrs	Unit N-1 Man Hours Per Sq In.	Unit N-4 Man Hrs	Unit N-4 Man Hours Per Sq In.	Unit N-2 Man Hrs	Unit N-2 Man Hours Per Sq In.	Unit N-3 Man Hrs	Unit N-3 Man Hours Per Sq In.	All Units Man Hrs	All Units Man Hours Per Sq In.
Chipping	586	.08	644	.06	240	.08	120	.06	1590	.07
Machining					160	.04	96	.07	256	.05
Welding	794	.11	784	.07	678	.10	306	.09	2562	.09
Peening and Grinding	773	.11	448	.04	468	.07	232	.07	1921	.07
Electrical	394	.06	176	.02	168	.03	224	.07	962	.04
Misc.	1023	.15	880	.08	788	.12	288	.09	2979	.11
TOTAL	3570	.51	2932	.28	2502	.38	1266	.39	10,270	.37
Area Sq. In.	7000		10,600		6670		3300		27,570	
Wt Welding Rod	596[A]		1,175[B]		1000		350		3,121	
Man Hrs Welding Per Lb	1.3		.67		.68		.87		.80	

A—546 lb 18-8 stainless steel rod, 50 lb mild steel rod

B— 70 lb 18-8 stainless steel rod, 1030 lb mild steel rod, 75 lb 4-6 chromium rod



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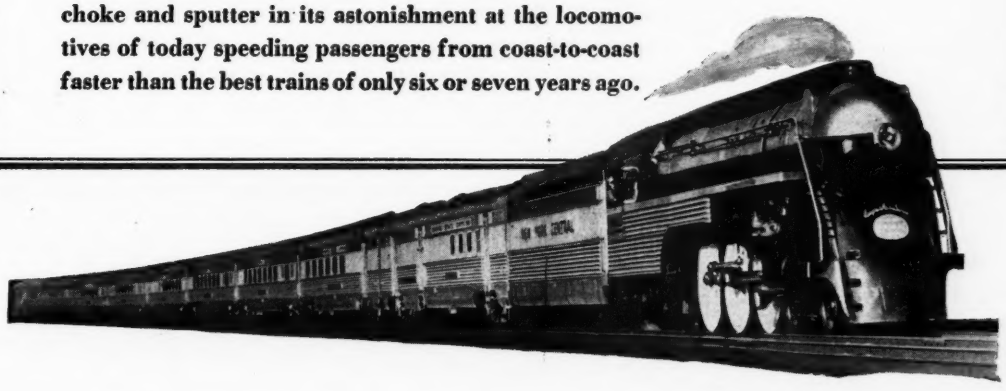

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SAVING 70 PER CENT OF FUEL OIL in Lighting Pulverized-Coal-Fired Boilers

No waving of flags, no "E" awards, no speeches, no movie stars—but the men who have been making this saving of valuable fuel oil ever since early 1942 have helped to keep Fortresses flying, tanks rolling, escort vessels dropping depth charges—in ever-growing numbers. The men are the operating engineers of Philadelphia Electric Co., cooperating with the boiler manufacturer's service engineers. The boilers are 600,000-lb-per-hr, 1250 psi, 925 F pulverized-coal-fired units. The procedure takes considerable observation and maneuvering, as the authors point out. It is a splendid example of practical power engineering at war—conserving fuel, transportation and manhours for victory

By C. V. Jones and J. J. Harper

Station Operating Department, Philadelphia Electric Company

EARLY IN 1942, the petroleum shortage in the Eastern part of the United States reached critical proportions and it was necessary for users of fuel oil to make all possible arrangements for conservation. Fuel oil was being used in lighting some of the boilers on the Philadelphia Electric Co. system. Consequently, studies were instituted, at one of the main generating stations, to find ways and means of reducing the amount of oil used for this purpose.

Description of Boilers

The boilers at this station are of the Babcock & Wilcox open-pass type, rated at 600,000 lb of steam per hour. The steam conditions are normally 1250 psi, and 925 F. The coal equipment is of the unit system type, each boiler being equipped with three Type "E" pulverizers. Each pulverizer supplies two coal burners of the inter-tube, multi-tip type; thus each boiler has six burners. Six Steam-Mechanical atomizing-type oil burners, each with a capacity of 135 gal per hr, are provided for lighting the powdered coal. The oil used for this purpose is Number 2 fuel oil at 50 lb pressure.

These boilers were installed in connection with a super-position turbine, which receives steam at 1250 lb pressure and exhausts into the older header system at 265 lb pressure. A reducing-valve system is provided between the high and low pressure headers through which the steam from the high-pressure boilers may be passed, when the topping turbine is out of service.

The drums of these boilers have a 10½ in. thick section near each end, and in order to eliminate the possibility of excessive temperature stresses, thermocouples have been installed in such a manner that the temperature on the outside of this thick section and the temperature of the water in the boiler are recorded. In putting the boilers on the line and taking them off the line, the procedure is to control the rate of change of temperature of the water so that the difference between the temperature of the water and the outside of the drum is limited to not over 75 F.

Lighting Procedure Formerly Employed

Until the spring of 1942, the method used in putting a boiler into service was to light four oil burners, and to cut burners in or out as determined by the temperature through the thick drum section. In this way, the boiler was heated up and the pressure increased until steam was being delivered to the low-pressure header system through a wide-open pressure-reducing valve. At that time one pulverizer with its two burners was put into service, which produced roughly one-third boiler output, and the pressure was increased on the boiler by gradually closing the pressure-reducing valve. The rate at which the pressure was increased was also determined by maintenance of a proper differential temperature through the thick drum section. Putting the boiler on in this manner normally required 1600 gal of fuel oil.

Present Lighting Procedure

Under the new procedure, the practice is to light two oil burners, for igniting coal. A pulverizer is then started, with the primary air damper closed, and one burner pipe open. The secondary air damper, on the burner to be used, and the two adjacent secondary air dampers are then opened slightly. The primary air damper is then opened just far enough to establish air flow through the mill without making the oil flame unstable. The coal feeder is then started and the secondary air dampers are adjusted to suit conditions. The rate of coal feed to the mill is automatically controlled by a pressure differential measured across the pulverizer. The feeder operates intermittently to keep the proper amount of coal in the mill.

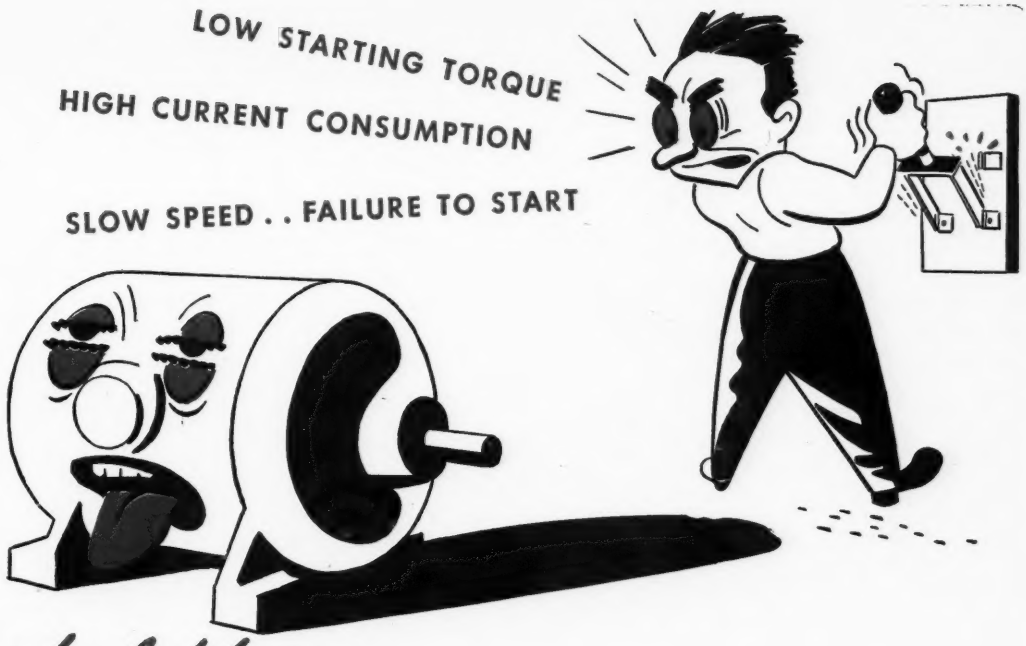
One oil burner is removed as soon as combustion conditions warrant, and the coal is fired with the aid of one oil burner. Firing is continued, using coal and oil for as long a period as the drum temperatures will permit.

The length of time it is possible to fire in this manner varies with the initial temperatures of the drum and the grade of coal available. If the boiler outage has been for a short period, such as a weekend, and the water has not been drained, the drum temperature will be close to 200 F, and the water temperature about 125 F. Starting under these conditions can usually be accomplished by continuous firing. However, if the unit has been off a sufficient length of time to come to room temperature, intermittent firing becomes necessary. This procedure requires about 500 gal of fuel oil per start.

Operating Details

It has been found that a coal having a volatile of 22 per cent,

(*Continued on Page* 124)



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"sluggish motor" grief

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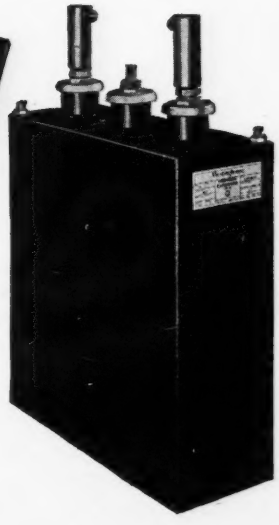

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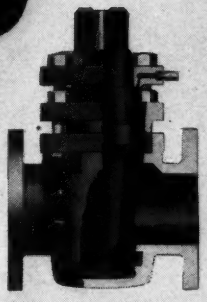
11-CS-1

READING-PRATT & CADY
ASBESTOS-PACKED COCK

Easy TO OPERATE THIS COCK ...it never sticks



Cross section of the body of the cock showing the location of the U-groove. Cock in main illustration has double gland feature. Top gland holds plug at pre-set pressure and the second gland independently compresses the gland packing.

The plug of this READING-PRATT & CADY double gland Asbestos-Packed Cock turns, even when used infrequently, with a fraction of the effort required to operate a ground cock. Yet it holds a constant, tight seal.

This is accomplished by the U-grooves of Asbestos which, in addition to providing this *tight* seal, minimize friction and provide a cushion to absorb expansion differential between plug and body.

Use it in lines that carry solids in suspension; for viscous fluids, oils, acids and alkalis. Paper mills, steel mills, packing houses, oil refineries, soap, dye-stuffs and by-products plants use it in many of their process lines—wherever globe, angle or gate valves fail or ground cocks prove unsatisfactory.

In addition to the iron illustrated above, designed for manufacture in bronze, cast steel, Ni-Resist cast iron and copper-free Ni-Resist cast iron.

READING-PRATT & CADY

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Portland

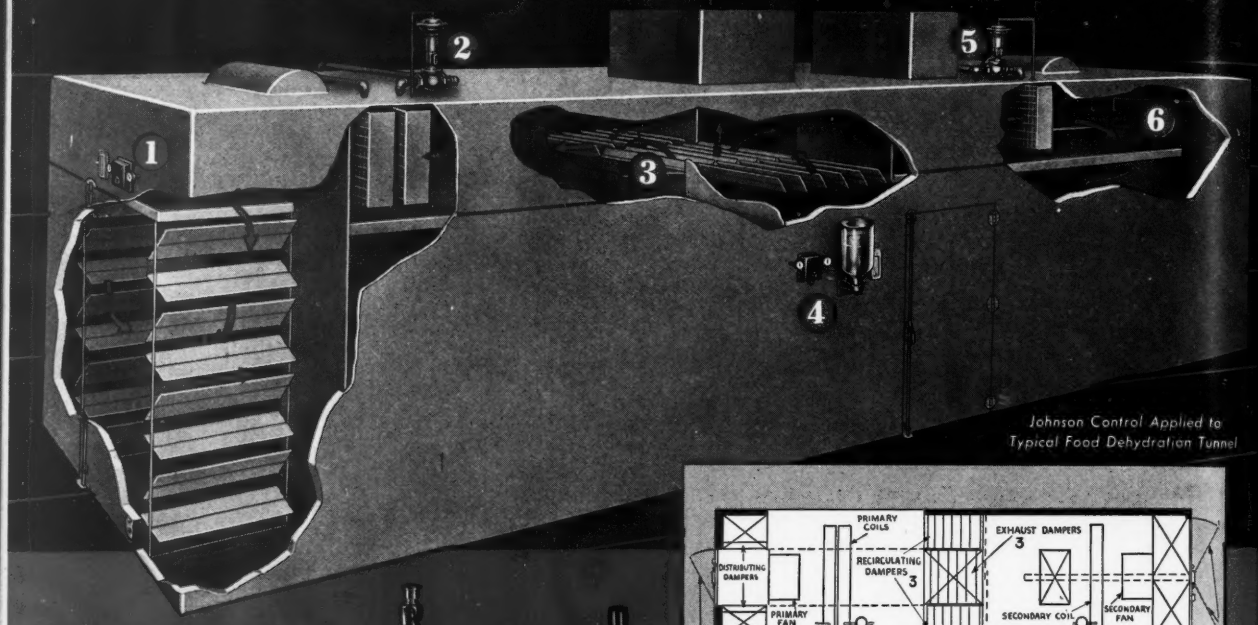
R
READING
CAST STEEL
VALVES & FITTINGS

P&C
PRATT & CADY
BRASS & IRON VALVES

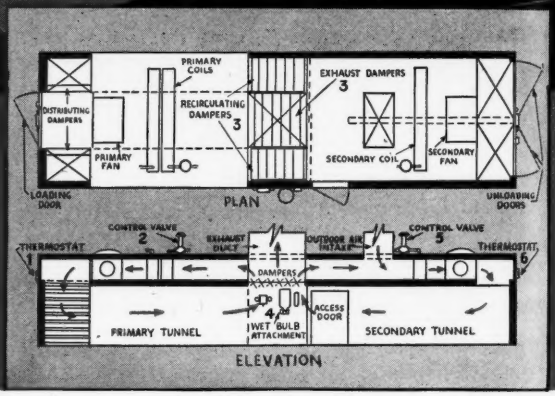
D'ESTE
VALVE AND
ENGINEERING
SPECIALTIES

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, Inc.,** BRIDGEPORT, CONNECTICUT

Johnson Control for Dehydration Tunnels

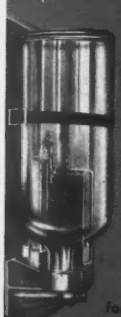


Johnson Control Applied to Typical Food Dehydration Tunnel



Proportioning Louvre Damper

Streamline Diaphragm Steam Valve



Wet-Bulb Attachment for Thermostat

Exact Temperatures and Humidities Prevent Spoilage of War Foods During Processing

Johnson versatility was never better demonstrated than in the dehydration of foods. Here again, Johnson Wet-Bulb and Dry-Bulb Controls maintain the optimum air conditions for the proper processing of foods, so necessary to the successful prosecution of the war.

In the above view, Johnson Insertion Thermostat No. 1 controls Diaphragm Steam Valve No. 2 to maintain the desired dry-bulb temperature in the primary tunnel.

Proper humidities are maintained by positioning the Return Air and Exhaust Dampers No. 3, as required, through piston-type damper motors, operated by Johnson Wet-Bulb Controller No. 4.

Final dry-bulb temperatures, as required by Government standards, are maintained in the secondary tunnel through the control of normally closed Diaphragm Valve No. 5, operated by Johnson Dry-Bulb Controller No. 6.

★ *Johnson Controllers are used, too, for the control of other food processing accessory equipment such as caustic peelers, etc.*

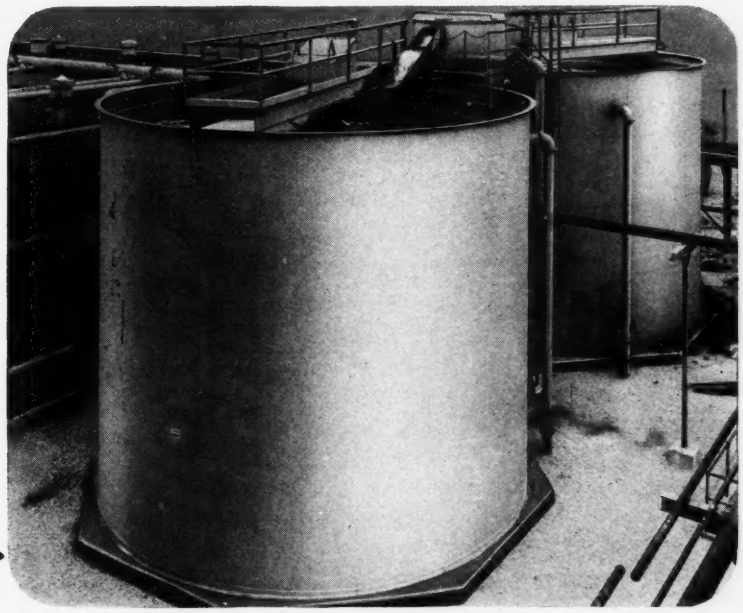
THE PROPER ATMOSPHERE

JOHNSON *Automatic Temperature and Air Conditioning Control*

JOHNSON SERVICE COMPANY, MILWAUKEE 2, WIS. · DIRECT BRANCHES IN ALL PRINCIPAL CITIES

Only 60 Minutes

REACTION AND SETTLING TIME REQUIRED



WITH GRAVER REACTIVATOR!

This equipment reduces the usual reaction and settling time . . . from 4 to 8 hours . . . to less than 1 hour

The Graver Reactivator is designed to both soften and clarify a water supply or perform either function separately, and embodies an improved process of coagulation with Upward Sludge Filtration. Experiences of Reactivator users show that even when treating extremely hard and turbid waters, treated water hardness did not exceed 3 grains per gallon and turbidity did not exceed 5 p.p.m. The Graver Reactivator performs this operation in less than 60 minutes. Furthermore, this equipment requires a minimum amount of operator attention and provides important economies in initial cost as well as in operating expense.

Graver Reactivators can be designed and built in any size to meet your individual requirements. Graver engineers will gladly discuss your needs with you and submit quotations without obligation.

Write Graver — today.

GRAVER TANK & MFG. CO., INC.

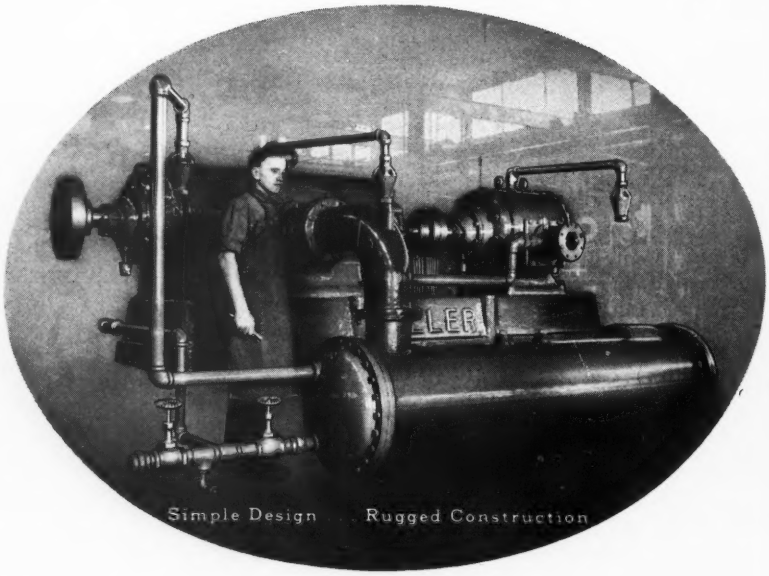
4809-85 Tod Ave., East Chicago, Ind.

NEW YORK CATASAUQUA, PA. CHICAGO TULSA

GRAVER *Water Conditioning Equipment*

43-40-W

Depend on FULLERS *for* Continuous Production



FULLER Rotary Compressors and Vacuum Pumps show very fine records for long, continuous operation. This is due, in a large measure, to the simple design and rugged construction of these units. They have remarkably few wearing parts—rotor, bearings, blades . . . operation without vibration and air flow free from pulsations.

One of the most impressive features of these units is the extraordinary capacity in relation to size. The shop assembly of the two-stage compressor illustrated, and since installed in an airplane factory, has a capacity of 1665 C.F.M. actual free-air delivery, 125-lb. pressure . . . occupies approximately one-half the floor space required for most types of machines of comparative capacity.

Become better acquainted with Fullers. Send for Bulletin C-5, illustrating and describing these machines. It's yours for the asking.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago 3—1144 Marquette Bldg.
San Francisco 4—421 Chancery Bldg.
Washington 5, D. C.—618 Colorado Bldg.

C-81

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

American Engineering Replaces German on Uruguayan Power Project

WITH AMERICAN ENGINEERING replacing German, a dam which will more than double Uruguay's power supply is expected to begin delivering power in 1945, following installation of a 30,400-kw waterwheel generator to be supplied by the International General Electric Co.

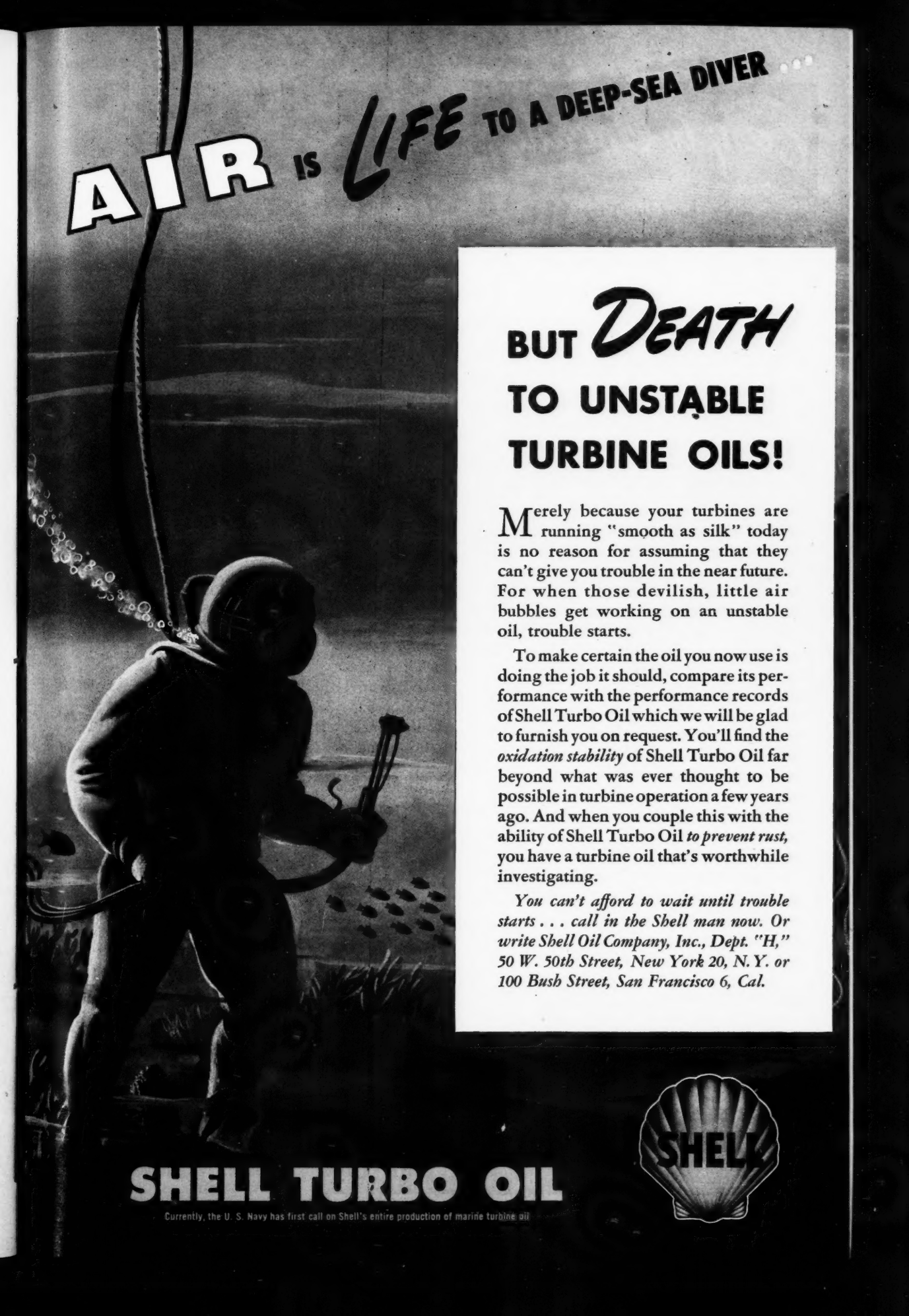
Located on the Black river, which crosses the entire country from northeast to southwest, the dam eventually will house four generators delivering a total of 121,600 kw.

The national government of Uruguay, which enjoys a monopoly of power generation and distribution, long has sponsored studies of hydro-electric possibilities. The Black river, the studies showed, had a total fall of 425 feet, with little water from October to April, so that construction of several dams, such as planned by TVA for the 650-mile, approximately 500-foot-fall Tennessee river, did not seem feasible.

When contracts for the project were awarded in 1934 most of them went to a group of German manufacturers and the dam proper was nearly completed at the site chosen—Rincon del Bonete, in the department of Tacuarembo—when the war brought work to a standstill. In January 1942, following the Rio de Janeiro Pan-American conference, Uruguay broke off relations with the Axis nations and in July of the same year the United States Export-Import bank loaned the government $12,000,000 to permit completion of the work. General Electric was awarded a contract for the first generator, which is now in the design stage.

The Black river dam is 130 feet high and has a length of 3850 feet, roughly equivalent to an average-size TVA dam. It will create a storage level of about nine million acre-feet at the normal level and a flood storage of three million acre-feet for a total of 12 million acre-feet.

Uruguay's only large power stations are two steam plants in Montevideo; the rest of the country, which supports two-thirds of the population of two and one-half million persons, being supplied chiefly by isolated plants operated by oil, which must be imported.



BUT DEATH TO UNSTABLE TURBINE OILS!

Merely because your turbines are running "smooth as silk" today is no reason for assuming that they can't give you trouble in the near future. For when those devilish, little air bubbles get working on an unstable oil, trouble starts.

To make certain the oil you now use is doing the job it should, compare its performance with the performance records of Shell Turbo Oil which we will be glad to furnish you on request. You'll find the *oxidation stability* of Shell Turbo Oil far beyond what was ever thought to be possible in turbine operation a few years ago. And when you couple this with the ability of Shell Turbo Oil *to prevent rust,* you have a turbine oil that's worthwhile investigating.

You can't afford to wait until trouble starts . . . call in the Shell man now. Or write Shell Oil Company, Inc., Dept. "H," 50 W. 50th Street, New York 20, N. Y. or 100 Bush Street, San Francisco 6, Cal.

SHELL

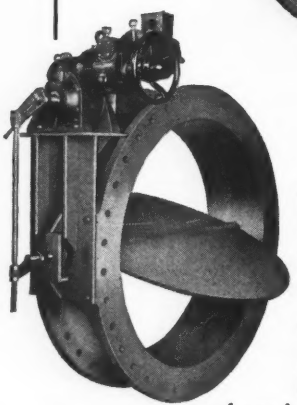
SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

Easy to Operate...

Streamlined for Self-Cleaning

16-inch cast iron chain wheel operated valve for pressures up to 15 pounds. Complete range of sizes from 2-inches to 84-inches.



Automatic electric-motor operated American Standard Valve with hand wheel for manual operation in case of current failure. Available in 125 lb iron, 150 to 900 lb steel.

The action of an R-S Butterfly Valve is rapid and smooth. Four to six revolutions of the hand wheel or chain wheel fully open or close the valve vane. The compact, inherently narrow face-to-face dimensions, and the fact that there is no long stem or gate well, reduce clearance requirements to the minimum.

There is free passage for direct flow with no restrictions other than the streamlined vane. Sediment cannot collect since there are no right angle bends or reverse turns. Hence, the R-S Valve is ideal for the control and shut-off of dirty gas, dirty water, pulverized fuel or similar flowing solids.

The beveled vane wedges tight against the valve body for shut-off duty.

Write for catalog and detailed information about the use of R-S metals for resistance against heat, abrasion and corrosion.

R-S QUALITY PRODUCTS SINCE 1908

15 to 900 psi

VALVE DIVISION

R-S PRODUCTS CORPORATION

4535 Germantown Ave. Philadelphia 44, Penna.

R-S Streamlined BUTTERFLY VALVES

Hydraulic Turbine Pitted Surfaces Repaired by Electric Welding

(*Continued from Page* 112)

were supervised by a representative from the Magnaflux Corp.

After building up the vanes with welded metal, five-man crews were used in grinding the welded areas to conform to the original contour. Horizontal templates were made to insure close accurate control of the work. The templates were constructed from the manufacturer's detail drawings and were then checked on the spare runner. Considerable variation in vane contour was found when checking from vane to vane on the spare runner. As a result, it was necessary to alter the templates to get an average vane contour. The templates were constructed to maintain 1 in. thickness of the trailing edge.

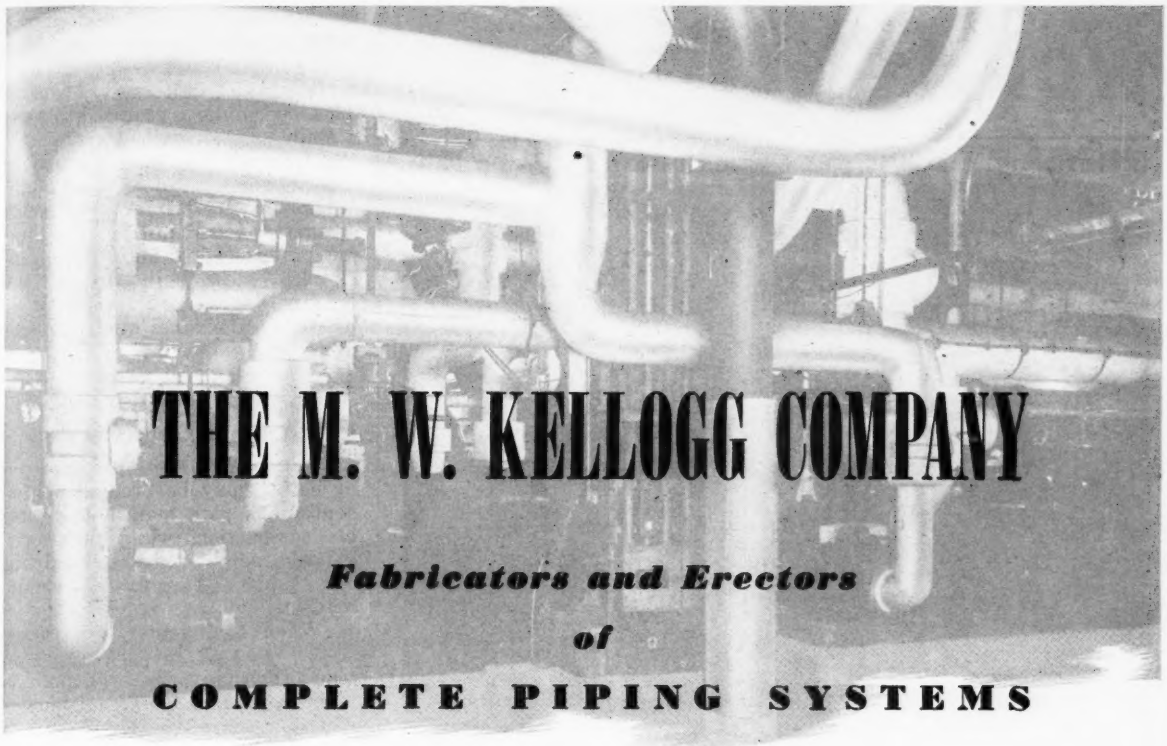
Costs in Man Hours and Materials

In studying the cost analysis Tables I and II, Figs. 6 and 7 should be observed closely. Unit N-1 is high in man hours per square inch of repaired area. This is due to the harder surface and the greater difficulties in grinding the stainless steel. It will also be noticed that there is some variation in man hour requirements, depending on the size of the area to be repaired. The reason for this is obvious. Costs of installing the platform and other equipment necessary for repairs remain constant regardless of the size of area. Table II shows how the detailed studies were made.

Figures 6 and 7 show the comparative costs and wearing qualities of mild steel and stainless steel. The low chromium surface showed no advantages and was difficult to apply and grind.

The advantages of welding resulted in finished vanes which conformed more accurately to correct contour than the original castings. The surface was smoother and more dense and was free from sand holes and porosity, as compared to the original runner surface, shown on Fig. 8. The result was an increase in output of approximately 4 per cent more horsepower than was obtained prior to welding repairs. It is obvious also that the cost of a runner replacement is saved and the useful life prolonged where otherwise it would have been necessary to remove the runners after approximately 3 yr operation.

As a result of the experience



THE M. W. KELLOGG COMPANY

Fabricators and Erectors

of

COMPLETE PIPING SYSTEMS

for

HIGH PRESSURE — HIGH TEMPERATURE
PUBLIC UTILITY and MARINE POWER PLANTS

* * *

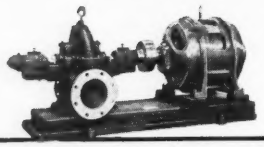
PROCESS PIPING FOR INDUSTRY

Heat Transfer Equipment for Industrial and Marine Power Plants

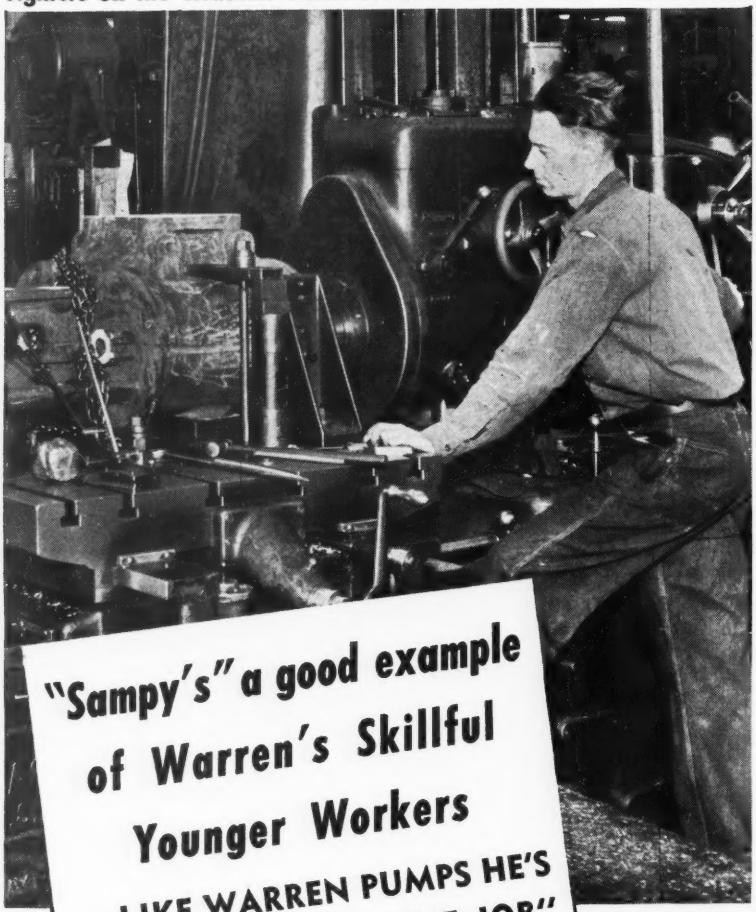
KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK 7, N. Y.
LOS ANGELES: 609 SOUTH GRAND — REPRESENTATIVES — TULSA: PHILTOWER BLDG.



Fighters on the WARREN PUMP Production Front. No. 7 of a Series



Among our younger but thoroughly experienced pump makers is Harold A. Sampson.

"Sampy", who operates a Horizontal Boring Mill, handling pump casings and other parts up to 30" sizes, has 14 years of Warren Pump experience behind him. He takes as deep pride in turning out the quality pumps that "are built to fit the job" as the skilled Warren Pump Makers who have been on the job for 20, 30 or even 40 years.

It is this pride that these skilled men take in Warren Pumps that enable Warren equipment to perform so faithfully in the gruelling 24 hour duty demanded in war plants or the do-or-die duty asked for in the United States Navy, Coast Guard and Merchant Marine. It is this pride that enabled these Warren Workers to win the Army-Navy "E" Award.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

obtained during this maintenance program, the specifications for a new unit at Boulder Power Plant included a definite advancement. The new runner is required to have a stainless steel welded surface at the entrance and discharge edges of the vanes, crown, and band. Approximately 321.5 sq ft of welded surface was required. The runner patterns could allow for ⅛ in. stainless steel built up in the heavier sections of the castings, but not on the vanes where the sections were thinner.

Saving 70 Per Cent of Oil in Lighting Boilers

(*Continued from Page* 114)

or better, may be fired at a low, continuous rate maintaining stable combustion, while the lower volatile coals require higher firing rates and must be fired intermittently.

When the boiler goes into service on the low-pressure system, the pulverizer output is raised and the second coal burner placed in service. The oil burner is then taken out and the pressure is raised by slowly closing the pressure reducing valve over a three to four hour period.

It may be readily understood that the present method of putting these units on the line involves considerable observation and maneuvering. However, the determination and willingness of the operators, with the cooperation of the boiler manufacturers' service department, to assist in the war effort has resulted in this saving of fuel oil.

It may be of interest to state here that the top drum of the unit is flooded until shortly before the boiler pressure reaches the low-pressure line and is also flooded when being cooled down, thus increasing the heat transfer rate and decreasing the time required for these operations.

Opening the doors in the setting between the boiler and the economizer, allowing air at room temperature to pass over the economizer, prevents the economizer from steaming during the starting period.

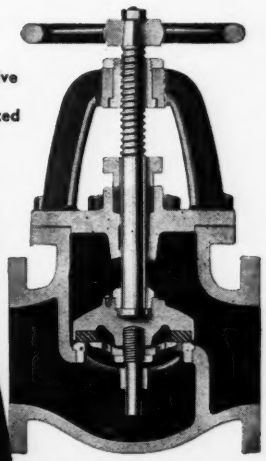
Results

Changing the method of starting the pulverized-coal-fired boilers in this one station has resulted in the conservation of approximately 14,000 gal of fuel oil per year. The reduction amounts to about 70 per cent of our former consumption.

Does Your Assistant Know HOW TO SELECT A VALVE?

Today, when it is more important than ever before to keep pipe lines flowing at maximum efficiency, too much care cannot be given to selecting the right valve for each job. Before you allow your assistant to specify a valve for that all-important line, make sure he knows what type is needed.

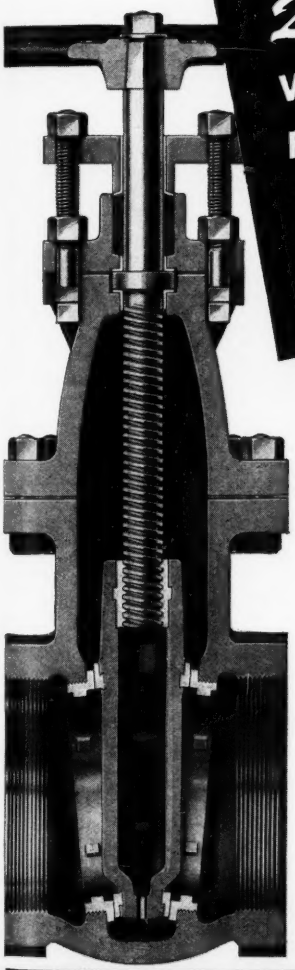
Here is the answer to a frequently-asked question on valve selection, taken from the files of The Kennedy Valve Manufacturing Co. Other questions will be considered in succeeding advertisements in this series.



Globe valve with bronze-faced disc

Question:

WHY ARE THERE SO MANY DIFFERENT TYPES OF VALVES?



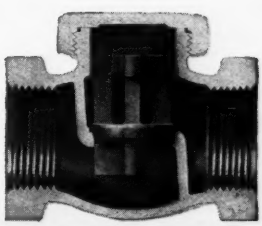
Answer:

Because no single design of valve is suitable for all applications . . . each is best for certain jobs. Double-disc gate valves, for example, are preferable where liquids containing grit are to be handled. Wedge gate valves are recommended for gummy liquids and are preferred for steam service by some engineers. Both types are better than globe valves for lines on which it is important to minimize resistance to flow. Globe valves should be chosen for throttling service and where the valve is to be operated frequently. Outside-screw-and-yoke gate valves provide visual indication of disc position but require headroom. Non-rising stem gate valves are not recommended for corrosive fluids because the stem threads are in contact with the substance handled. Lift-check rather than swing-check valves are preferred for a pulsating flow.

GIVE THE VALVE A CHANCE . . . SELECT IT FOR THE JOB. IF YOU DON'T KNOW WHAT VALVE TO SPECIFY, ASK YOUR DISTRIBUTOR OR WRITE TO THE MANUFACTURER.

If you have a valve selection problem, write to us. As Kennedy makes a complete line of standard gate, globe, angle and check valves, you can be sure of receiving unbiased help. For full description of Kennedy valves, pipe fittings and fire hydrants, send for 240-page Kennedy Catalog.

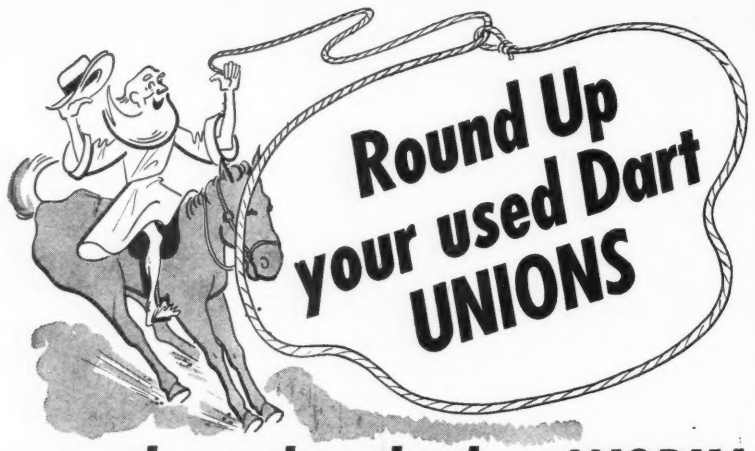
Iron body wedge gate valve



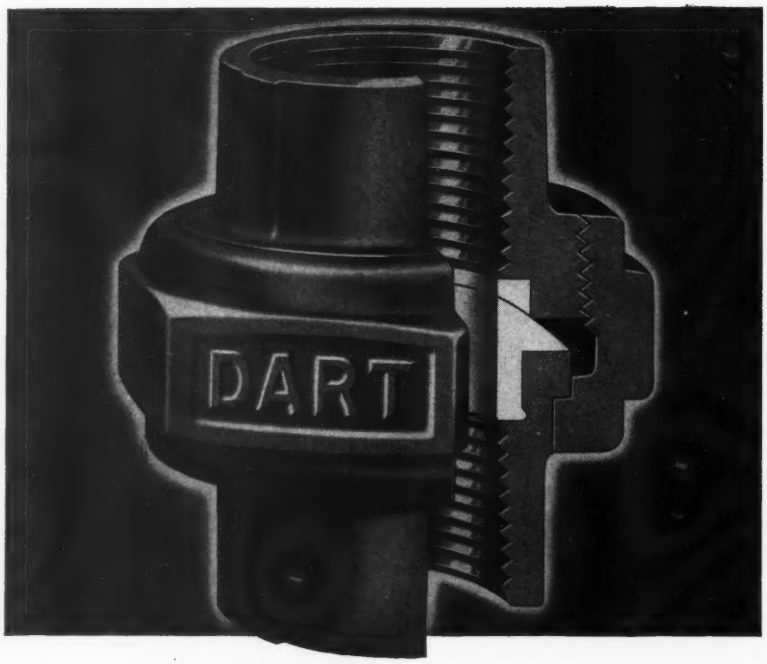
Lift check valve

KENNEDY VALVES • PIPE FITTINGS • FIRE HYDRANTS

THE KENNEDY VALVE MFG. CO. • ELMIRA, N. Y.



... and put them back to WORK!



DON'T feel sorry for your used Dart Unions if they are "corralled" and put back to work. Dart Unions are *made* to be used over and over again—and give reliable, tight-joint performance each time, too.

Here are some reasons why Darts can "keep on going" after ordinary unions are forced to quit. Darts have matched bronze seats, ground to true-ball surfaces for correct, leak-proof seating . . . clean-cut threads that prevent scoring . . . extra heavy bodies and nuts made from High-Test Air Refined Malleable Iron that withstands rough handling.

If you *still* have any used Darts idling their time around your plant, head them for "the last round-up"—and get them back on the job. If you need *new* Darts, see your supplier today.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

NEW EQUIPMENT

Information that you desire about any equipment will be gladly furnished without obligation. WRITE TO POWER PLANT ENGINEERING

Dehydrator Prevents Corrosion in Packing War Goods

A SIMPLE, quick technique for packaging guns, engines, planes and machinery to prevent rusting and corrosion damage during the weeks and months that these metal war implements lie in freighter holds and dockyards has been made possible by the development of a chemical that not only can suck half its weight in moisture out of damp air, but also signals workmen when the humidity inside a war package rises above the point where rust occurs. The chemical is granular silica gel made by the Permutit Company.

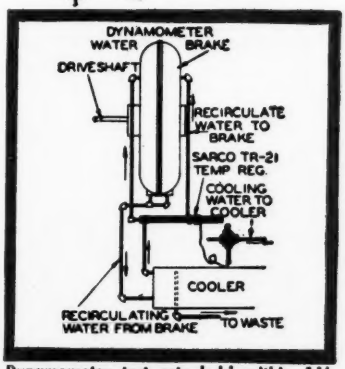
Till World War II, metal war goods were coated or "slushed" with heavy grease to keep moisture off. The grease-coated parts then were de-greased in solvent or vapor-baths before assembly—which delayed putting munitions to work at the front and multiplied the work of harassed mechanics.

With silica gel this time-consuming de-greasing is eliminated and equipment arrives ready for use. The chemical protects metal parts by keeping the humidity of the entire package below 20 per cent—at which point corrosion cannot take place. Silica gel granules absorb half their weight of water by physical action and do not swell, dissolve, or have any chemical reaction during the absorbing process.

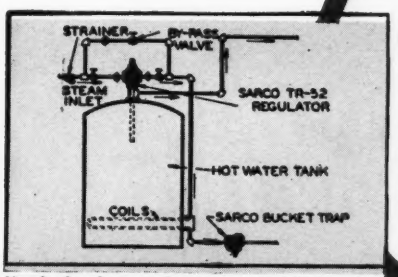
By examining a humidity indicator in each package—a card containing cobalt-impregnated silica gel which changes color as the air within the package changes in humidity—inspectors can tell when the silica gel has absorbed its capacity of the moisture in the package, or if the moisture-proof wrapper is leaking. When the air is dry the cobalt granules are a deep blue, but as humidity in the package increases, the granules change to violet through pink to white.

"Of course it can be done"

Every year more equipment manufacturers incorporate Sarco steam traps and temperature control as a part of their original equipment, and Sarco strainers are used by the thousands for pipe line protection. It's good business—good insurance for the satisfactory operation of the product. A few of the applications are shown on this page.

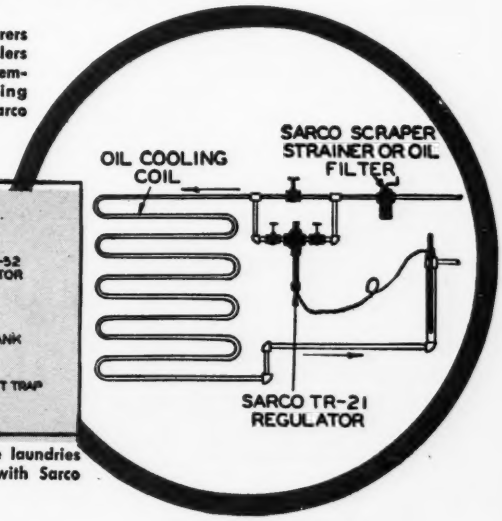


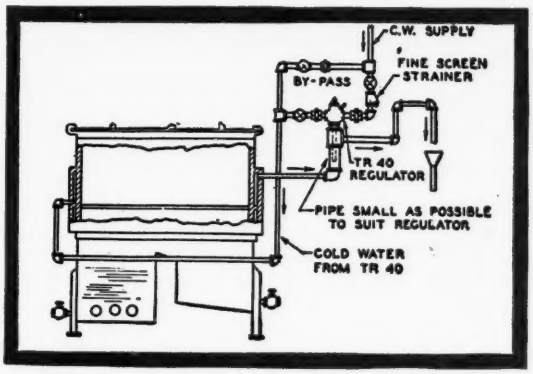
Dynamometer test sets held within 1½ degrees with Sarco Temperature Control.



Hundreds of water heaters on mobile laundries are equipped by the manufacturer with Sarco TR-52 regulators.

Leading manufacturers of Quench Oil Coolers assure constant oil temperatures by fitting each unit with Sarco cooling controls.





Manufacturers of degreasers use the Sarco TR-40 cooling control and the Sarco vapor line control extensively.

Manufacturer of metal washing machines standardizes on Sarco *TR-50* control.

Ask Sarco First

Many of the unusual Sarco applications have been instigated by customer requests. Give us a chance to say "It *can* be done."

The Sarco Hook-up Book gives many suggestions for product design engineers.

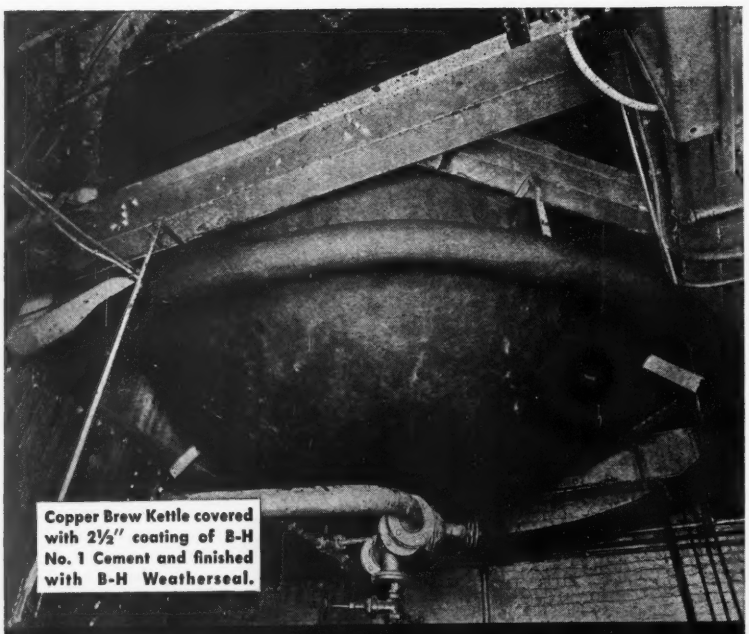
19

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO



SOMETIMES IT PAYS TO LAY IT ON THICK!

Use B-H WEATHERSEAL to Protect Exposed Insulation

Cover all insulation exposed to infiltration of water or moisture with B-H Weatherseal. This Baldwin-Hill product is an emulsified, asphalt compound furnished ready-mixed in plastic form. By reason of its exceptionally high coverage and low percentage of shrinkage, the per square foot cost is low. One hundred pounds will cover 55 square feet of surface ¼ inch thick. After drying, dehydration reduces the thickness to ⅛ inch, giving a smooth, complete seal over the entire area. You simply trowel it on. Stays permanently black—no fading or spotting. Send for generous sample of B-H Weatherseal and see for yourself how easily and thoroughly it works.

BH BALDWIN-HILL CO.

577 KLAGG AVE. • TRENTON 2, N. J.

NEW YORK, N. Y. • CHICAGO, ILL. • HUNTINGTON, IND. • KALAMAZOO, MICH.

In corrosion-proofing an aircraft engine, bags of silica gel are tied to each cylinder and placed in other strategic spots and the humidity indicator card is attached to one end of the engine. A moisture-proof bag is drawn over the engine before crating, and a transparent plastic window in the shipping box permits inspectors to check the indicator card without disturbing the wrap. Guns and other ordnance items are similarly sealed and crated.

Rotary Hand Pump

AN ALL-BRONZE rotary hand pump, that develops a pressure of 125 psi and has a capacity of 1.5 gpm, has been designed by the Blackmer Pump Co., Grand Rapids, Mich. This new unit is being furnished to the U. S. Maritime Commission and is used for high-pressure hand pump applications aboard ship, such as handling certain types of lube oils and fuels.

In addition to its marine uses, the pump has a number of industrial and commercial applications, chiefly in connection with hydraulic control devices and other equipment where high pressure, hand-operated pumping units are required. The new pump will become a standard unit in the Blackmer line of rotary hand pumps.

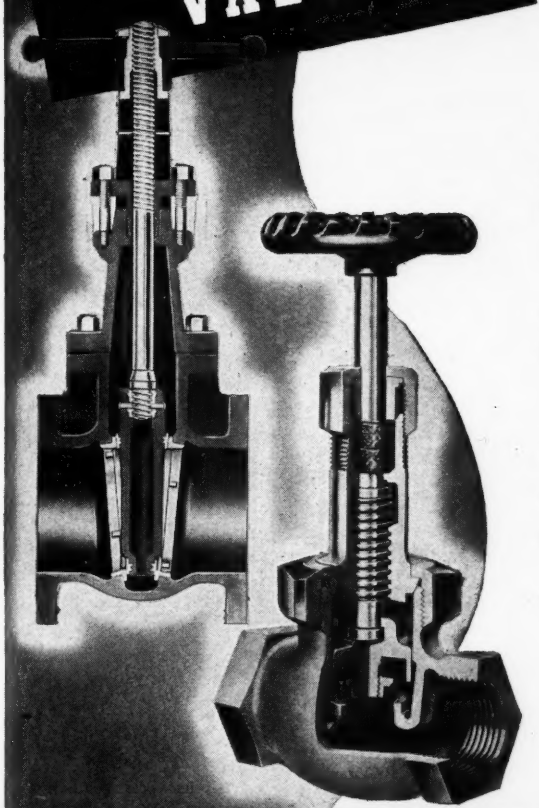
50,000-Volt Portable Test Set

A NEWLY DESIGNED 50,000-v portable test set for use on single-phase, 115- or 230-v, 50- or 60-cycle circuits has been announced by the General Electric Co. The set is intended for application in cable factories, industrial plants, central stations, laboratories, and wherever high voltages up to 50,000 v are required for testing electric apparatus or insulating materials.

This 50,000-v (5-kva) portable set combines in a compact unit an oil-insulated testing set, a highly accurate indicating voltmeter, a voltmeter selector switch, and complete control equipment, such as air circuit breaker, line switch, foot switch, and induction voltage regulator. The testing transformer is designed with liberal safety factors to withstand the stresses encountered in testing service. A screened safety guard separates the operator and the

World's Largest Office Building uses FAIRBANKS VALVES

Pentagon Building, Arlington, Va.
Charles S. Leopold, Mech. Eng.
Baker-Smith & Co., Inc.—Mehring & Hanson—Heating Contractors
Fred Brutschy Co., Plumbing Contractors
Carlson Bros., Power Piping Contractors



The Pentagon Building, Arlington, Va., occupies a gross area of 6,000,000 sq. ft., has sixteen and one-half miles of corridors and houses forty thousand persons.

Uncle Sam put Fairbanks Valves to the "acid test", with the result that the majority of the valves in this gigantic structure are "Fairbanks".

Isn't the judgment of the men who chose Fairbanks Valves for this enormous building a safe guide for you to follow?

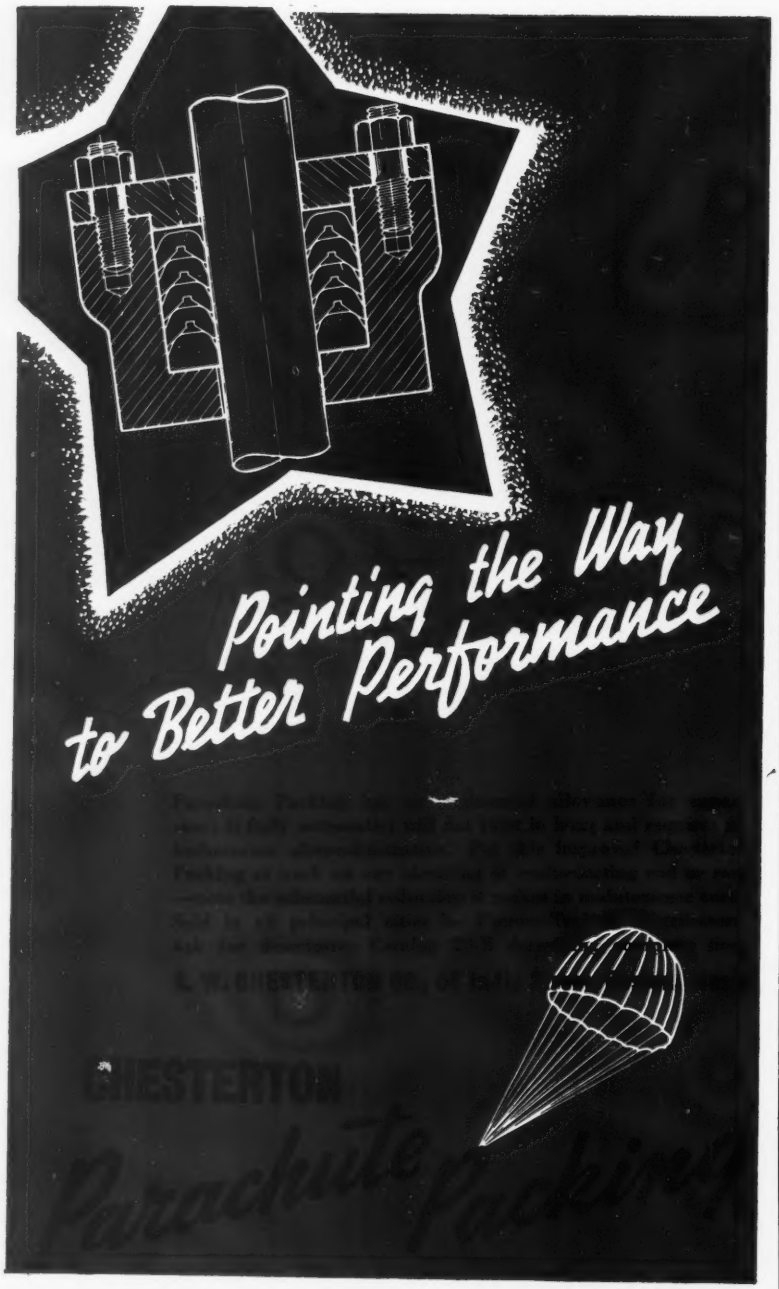
Fairbanks Valves are made in bronze and iron, in types and sizes for practically every service. Write for Catalog No. 42 and name of our nearest distributor.

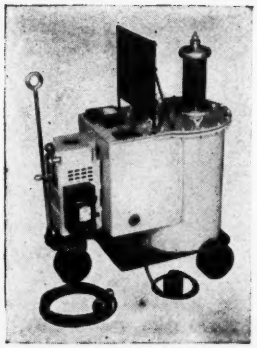
BACK THE BOYS AT THE FRONT. BUY WAR BONDS

THE FAIRBANKS COMPANY
393 Lafayette St., New York 3, N. Y.
Boston, Mass. Pittsburgh, Pa.
Distributors in Principal Cities

F

Fairbanks *Standard and* Renewable Valves





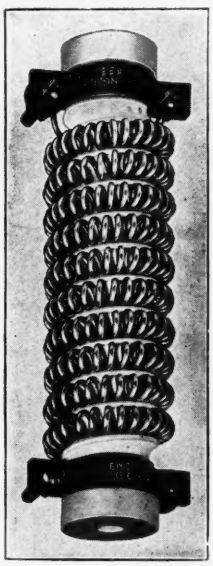
high-voltage bushing, and a red light warns the operator whenever the set is energized.

The indicating voltmeter has a large dial which shows the applied test voltage in kilovolts. For greater accuracy throughout the complete range, the meter has a double scale—one for voltages up to 25 kv and the other for voltages from 25 to 50 kv. The meter is connected to voltmeter coil wound on the main transformer. It gives a highly accurate indication of the actual test voltage under all conditions.

The three-wheel truck on which the set is mounted is provided with roller-bearing mounted wheels, and a ball-bearing mounted swivel joint for the front wheel, providing easy portability.

Radiant Heater and Resistor

A NEW REGAN radiant heater and resistor has gone through the development stage and has recently been placed on the market by Techtmann Industries, Inc., 828 N. Broadway, Milwaukee, Wis. This heater has demonstrated its ability to withstand temperatures up to 1700 F.



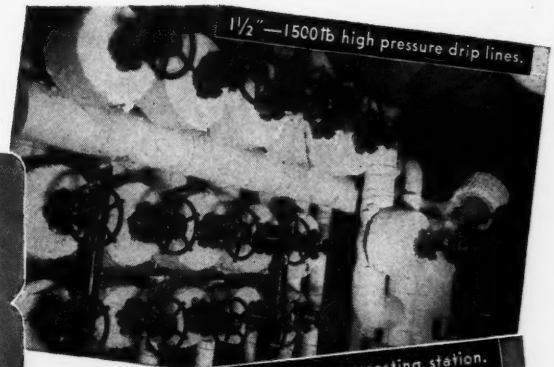
Designed for use in annealing ovens, electric furnaces—wherever high temperature radiant heat is required—the Regan Radiant Heater also serves as a resistor. The element consists of a helica coil of nickel chromium wire wound spirally around the refractory core. The binding posts and straps are of monel metal or nickel chrome, depending upon the user's specifications.

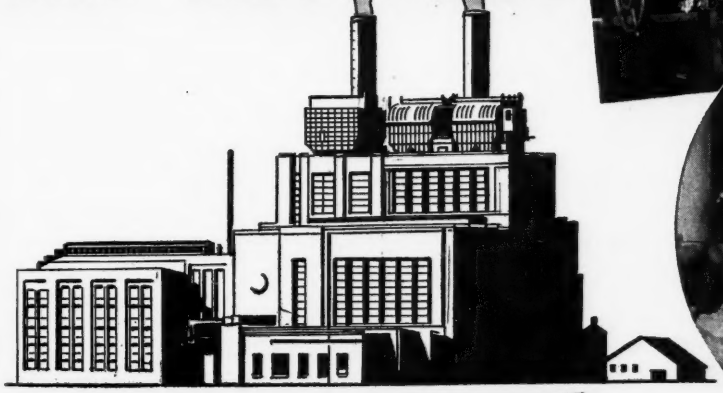
CHANGE OF ADDRESS

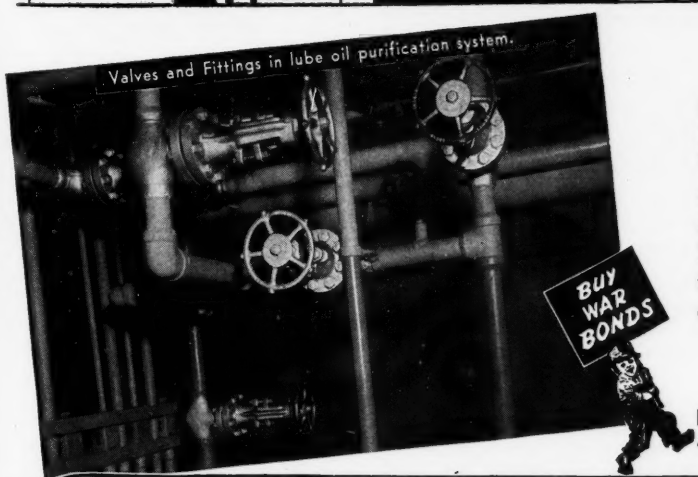
To avoid missing an issue or paying for forwarding postage be sure to send a change of address to our office. Changes received by the 20th of the month can be made effective for following month's issue.

POWER PLANT ENGINEERING

Uninterrupted POWER *for* WAR INDUSTRIES







● **SAFE and SURE control of vapors and liquids in steam generating plants serving our War Industries is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop Forged Steel* Valves, Fittings, and Flanges made by Vogt continue to play a vital part in the smooth, efficient operations of America's leading power plants.**

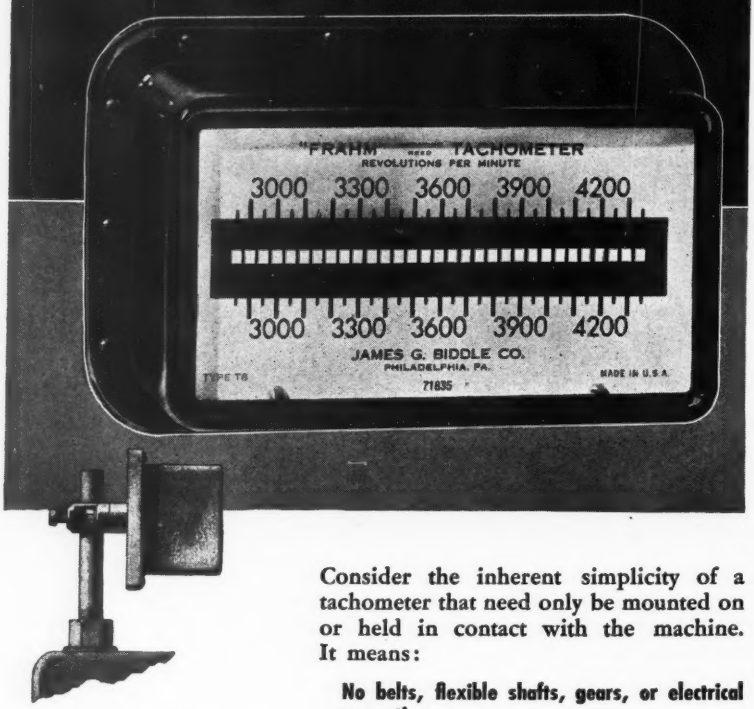
Catalog F-8 is the *drop forged steel* Valve and Fittings Blue Book.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky
Branch offices: **New York, Philadelphia, Cleveland, Chicago, Dallas.**

Vogt DROP FORGED STEEL **VALVES, FITTINGS & FLANGES**

THE "FRAHM" VIBRATING REED TACHOMETER...

...is Simple as ABC



Above: Showing one method of mounting the Frahm Tachometer.

Below, left: Frahm Hand Tachometer.

Below, right: Frahm Permanent Mount Tachometer.

Consider the inherent simplicity of a tachometer that need only be mounted on or held in contact with the machine. It means:

No belts, flexible shafts, gears, or electrical connections.

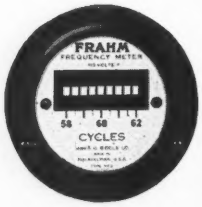
No lubrication required; No maintenance.

Independence from any outside source of power.

And the Frahm Tachometer is as accurate as it is reliable. It functions faithfully without attention year after year because there are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or connecting wires—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Furnished in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, Diesel-electric installations, etc. Various ranges available from 900 to 30,000 r.p.m.

For a complete description of Frahm Tachometers, together with list of types and ranges commonly supplied, write for Bulletin 1590-PE.



"FRAHM" VIBRATING-REED FREQUENCY METERS—operate on the same unique principle as Frahm Tachometers, except that reed vibration is produced electrically instead of by direct mechanical contact. Unaffected by wave form or ordinary temperature changes. Switchboard, portable and miniature types in various ranges from 10 to 500 cycles per second. Write for Bulletin 1695-PE.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

New Canton Stoker

CANTON De Luxe Wormfeed, Side Dump Stokers, manufactured by Canton Stoker Corp., 1100 Andrew Pl. S.W., Canton, Ohio, are now available with unit fan and motor mounting at the front of the stoker. The new model is called the "DELUXUNIT."

Easier operation is secured and very often valuable space is saved by combining all the working parts of the stoker at the front. Costs are usually lower with this arrangement, particularly when converting from oil, gas or handfiring.

As the illustration shows, the DELUXUNIT is available not only with a full furnace front, but also available with lower front and ashpit doors only, as the job requires.

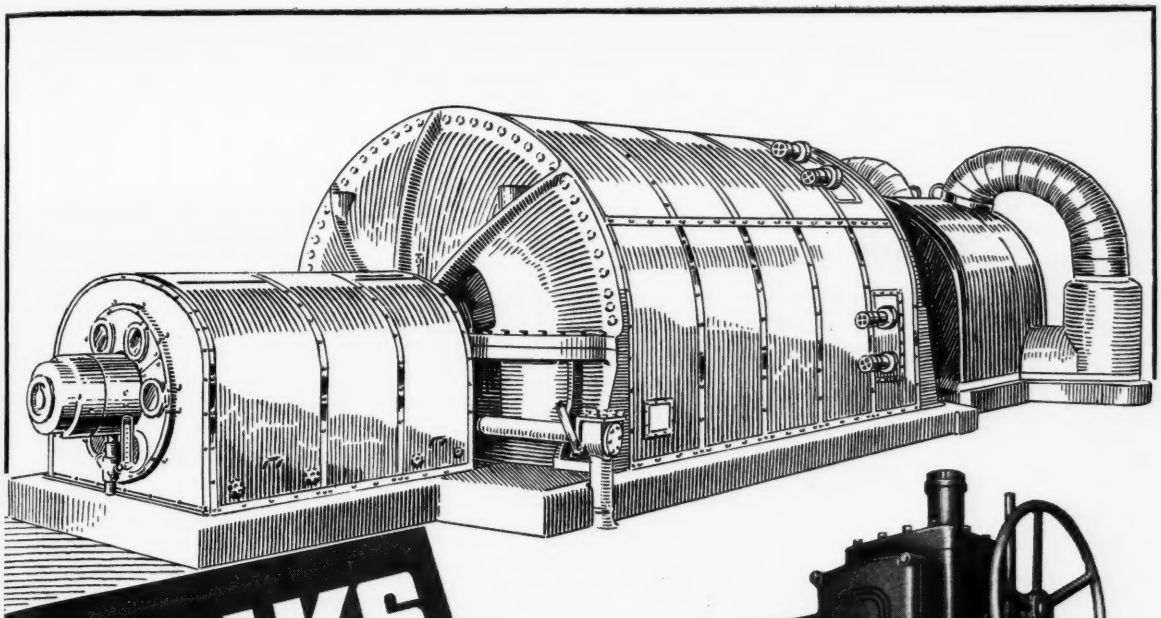
Diesel Efficiency Dial

THIS NEW DEVICE a Diesel Efficiency Dial, developed by Bacharach Industrial Instrument Co., 7000 Bennett Street, Pittsburgh, Pa., is intended to simplify the interpretation of Diesel engine indicator tests. It automatically correlates cylinder pressure and exhaust temperature readings to show instantly defects in Diesel engine operation. For instance, if the engine exhaust temperature is high with a normal cylinder pressure, the calculator indicates that there is scaling of cylinder jackets.

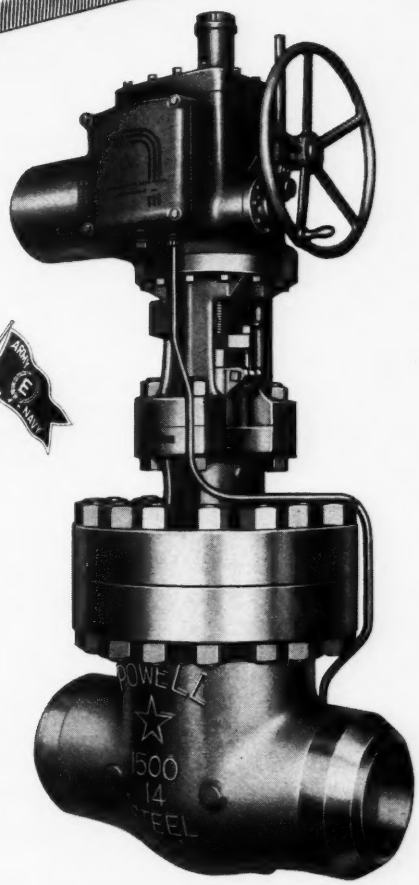
The dial is designed as a time saver for any Diesel engineer and an aid for Diesel school instructors and students. While it is made primarily for users of the engine indicators made by Bacharach, a quantity has been allotted for educational purposes and copies will be sent upon request while the supply lasts.

Curtain Type Damper

PRAT-DANIEL CORP., through its sales agent, The Thermix Engineering Co., Greenwich, Conn., is now the distributor of the Heacon curtain type damper, three units of which are shown in the illustration. The damper consists of a large sheet of asbestos material which in the open portion of the damper is wound around a roller by means of a



LINKS IN THE CHAIN OF VICTORY



Every time you hear of the industrial miracles that are being performed today, remember that wherever there is production there must be power and that, *next to the men,* the most important links in the chain of victory are the valves that control the liquids and gases that give power to industry.

POWELL devotes to the manufacture of valves . . . and valves only . . . the skills developed through nearly a century of *specialized* valve manufacture.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

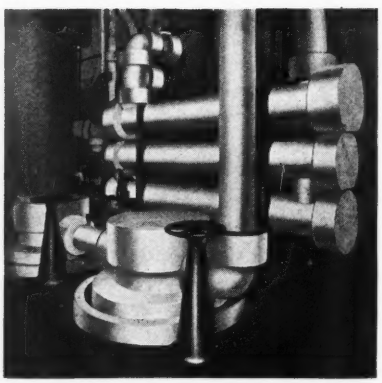
Fig. 1323—Designed for MORE Power — A Class 1500-pound, 14-inch, Cast Steel welding end Gate Valve. It is equipped with top mounted, spring compensated, electric motor operator for quick, positive opening and closing.

POWELL VALVES

HENSZEY CONTINUOUS BLOWDOWN

is SAVING EQUIPMENT, MANPOWER and FUEL in HUNDREDS of AMERICA'S POWER PLANTS

- ***Saving* EQUIPMENT:** The Henszey Blowdown System prevents priming, foaming and carryover . . . and also prevents the formation of scale by simple chemical treatment of the feed water. Boilers last longer and tube burns are kept at a minimum. The resultant clean steam makes packings last longer—reduces wear on rods and cylinders—reduces turbine blade erosion—prevents sticking of reducing valves, traps, etc.—prevents superheater burnouts.
- ***Saving* MANPOWER:** The Henszey System is completely automatic. Boiler shutdowns and repairs are reduced to a minimum. No man hours lost unnecessarily replacing packings, repairing or replacing rods and cylinder rings, turbine nozzles, turbine blades, valves and other equipment along the line.
- ***Saving* FUEL:** The Henszey System offers complete, automatic blowdown without heat loss—a big fuel saving in itself. Then, too, boilers free from scale and sludge are more efficient—they require less fuel to produce the power load.



Plan NOW for LOW COST POWER

Send for our folder "Complete Automatic Control of Boiler Concentration."

HENSZEY COMPANY

Dept. C11 • Watertown, Wis.

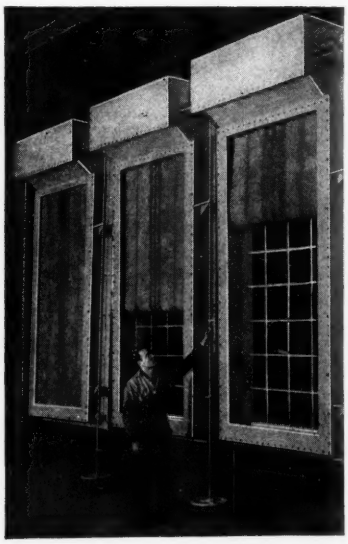
HENSZEY

CONTINUOUS BLOWDOWN

Flow Indicators • Distillation Systems • Heat Exchangers

Feed Water Meters • Boiler Feed Regulators • Proportioning Valves

suitable winding gear operated either manually or by means of a motor. To close, the weight of the roller pulls the asbestos sheet down over the seals located around the periphery of the duct. The steel checker frame supports the curtain against the chimney suction.



In design, the damper is readily adapted to replace older types in existing plants and is particularly effective in the control of the flow of gases. One of its noteworthy applications is for shut off when a boiler or complete boiler plant is temporarily closed down, since, when closed, it forms a seal that is practically leak proof.

Turbine Reduction Units

COMPLETELY SELF-CONTAINED, industrial turbine reduction units of a new standardized line have been announced by the Cone-Drive Division, Michigan Tool Company, 7171 E. McNichols Road, Detroit 12, Mich.

The line has been developed from the naval turbine reduction units produced for the U. S. Navy in large numbers in recent years. Built around the use of area-contact, double enveloping cone-drive gearing, these units are inherently more compact than would be possible with other forms of right angle drive gearing of equal load capacity.

These units are being made available at this time in 26½ and 37 hp base ratings. Both types are designed to operate on input speeds of 5000 to 6000 rpm. The two basic units are available in a selection of standard ratios ranging from 3½ to 8 to 1.

CONSULT *Gilmer* WHEN YOU NEED A BELT

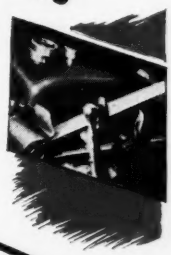
Gilmer makes a complete line of standard V-Belts, Endless or Non-endless Flat Belts, and a complete range of highly specialized belts for use wherever standard belts are unsuited. For complete information about the various Gilmer Belts and their plant applications, write for a FREE copy of the Gilmer Belt Catalogue.

OTHER FAMOUS GILMER BELTS

Flat Roll Belting for line shaft drives
Round Endless Belts
Special Endless Belts
Planer Belts
and Belts for Textile and other specialized industries.

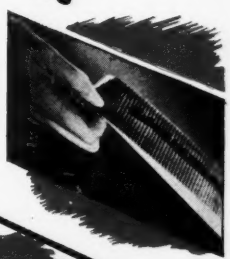
GILMER SPEEDAGE BELTS

Woven endless, without splice, for speeds to 10,000 FPM. and over. No vibration, light weight, and special treatment to increase co-efficient of friction is available at no extra cost. This belt solves high speed belt problems.



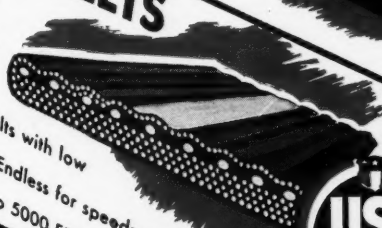
GILMER HEVALOID ENDLESS BELTS

Endless belts which are particularly adapted to precision work at top speed of 9000 FPM. They are made under the Hevaloid patent with special compound that provides a high co-efficient of friction, oil and heat resistance. Light weight for high speeds; built endless without lap or splice.



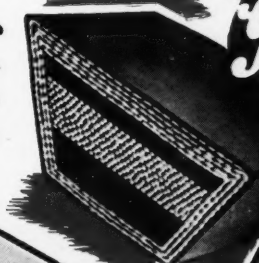
GILMER KABLE KORD BELTS

(Endless or Non-endless) Built on a contactor-belt principle of rubber-fabric and tough cord, Kable Kord gives you two-belts-in-one. Exceptional grip and strength combines in these flat belts with low stretch, little slippage, and extra tensile strength. Endless for speeds up to 6000 FPM. Non-endless where required, speeds to 5000 FPM.



GILMER V-BELTS

Built to lock in the groove with a rugged, non-slip grip. Made in standard sizes, completely interchangeable, these space-saving, shock absorbing belts may be had for single or multiple drives. Low maintenance cost is assured.



USE WHAT YOU LOSE

Gilmer BELTS

The Gilmer Engineering Staff has planned a National Power-Recovery Plan . . . a FREE wartime service to industry . . . approved by the WPB . . . to save power in the following services: Steam, Gas, Water, Electricity, Mechanical Transmission, Boilers, Compressed Air, Refrigeration and Prime Movers. Write for your FREE copy today.

L. H. GILMER COMPANY
TACONY, PHILADELPHIA 35, PA.
The Oldest Firm of Rubber Fabric Belt Specialists

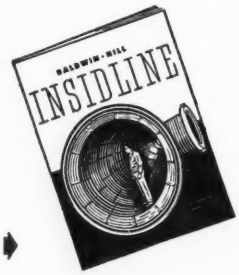
Insidline installations in pipe from 2" I. D. to 36" I. D. are made with a cartridge type of insulation that is built up first and then drawn into the pipe.

In larger diameters from 36" up to over 100", a panel type of Insidline is built up on the inside of the pipe.

Many new processes involve the piping of flue gases, steam, petroleum gases, hydrogen, and fluid catalysts at temperatures up to 1500° F., pressures up to 300 pounds, and velocities up to 500 feet per second.

Insidline, an internal insulation, was developed to enable ordinary carbon-steel pipe, with its comparatively light weight and low cost, to stand up under these conditions. The insulation holds the temperature of the piping to 750° F. or below, where the phenomenon of "creep" does not occur, and the pipe can be operated indefinitely at the usual stress allowances. The use of Insidline simplifies pressure-piping design, too, by reducing the number of expansion joints, bends, and other provisions for pipe expansion.

If you have a high-temperature, pressure-piping problem, it will pay you to investigate Insidline.



Send for descriptive booklet.

BALDWIN-HILL CO.

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Self-contained, they are completely equipped with built-in oil pump and oil cooler, oil filter and pressure relief valve, pressure gage, thermometer, and oil level gage. The lubrication system is of the force feed type.

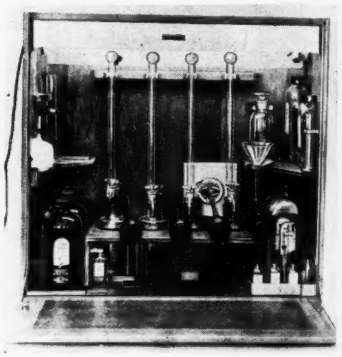
Silver Babbitt

THE CREATION of silver babbitt is a direct outgrowth of the shortage of tin, due to the war. The Battelle Memorial Institute of Columbus, Ohio, has made exhaustive research to find a babbitt metal that is comparable to tin-base babbitts. The ideal was to create a babbitt that would have the same bondability and corrosion resistance as that of tin-base babbitts and which would retain its hardness at operating temperatures without squeezing out. The answer was found in silver alloyed with a properly balanced lead base babbitt.

This new silver babbitt metal is now produced by National Bearing Metals Corp., St. Louis, Mo., with the authorization of the Battelle Institute.

Water Testing Cabinet

W. H. AND L. D. BETZ has announced the development of a new test set for boiler water control analyses which includes all the necessary apparatus and chemicals for the determination of hardness, alkalinity, chloride, sulfite and phosphate.



A special cabinet designed for use on table or wall is provided. All apparatus and chemicals are contained in the cabinet, held in a secure position and ready for instant use. A portion of the opened cabinet door forms a convenient acid-resistant laboratory work table and a fluorescent light provides correct illumination for the tests. The protection afforded by the cabinet minimizes breakage and eliminates errors caused by dust and dirt.

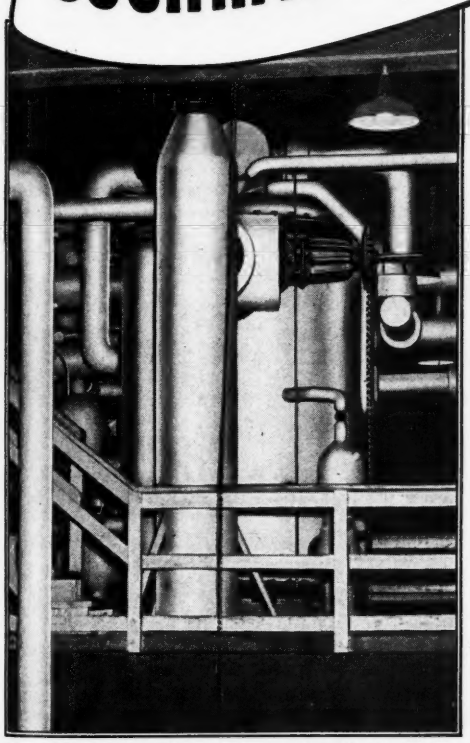
Lubricating Oil Reclaiming Unit

YOUNGSTOWN MILLER CO. of Sandusky, Ohio, has designed, built and delivered to the Marine Corps a mobile lubricating oil reclaimer for use back of the lines as the troops advance. Mounted on the trailer is a standard type Y-M reclaimer, a Diesel electric generating set, clean oil storage tank, fuel oil tank, the waterproof storage bins for refinery earths, filter papers and spares.

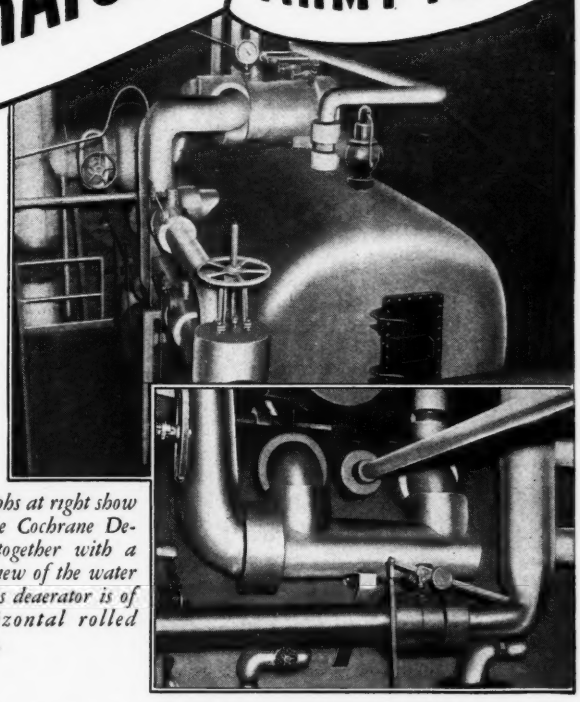
In operation, a charging pump conveys the dirty oil from drums on the ground to the heating tank, where it is brought to a sufficient temperature in intimate contact with refinery earth to dissipate the volatiles. The heating

COCHRANE DEAERATORS ARE IN THE ARMY TOO!

BACK THE ATTACK ★ BUY WAR BONDS



View of vertical Cochrane Deaerator installed in power plant of large Army base. Cochrane Deaerators like these are protecting boiler plants in war industries all over the country, insuring feedwater of "zero oxygen" content.



Photographs at right show one of the Cochrane Deaerators together with a close-up view of the water inlet. This deaerator is of the horizontal rolled plate type.

The photographs shown here illustrate two Cochrane Deaerators installed in one of the army's important power plants in the south. While the function of the deaerator is a relatively minor one in the production of the implements of war, it is gratifying to realize that because of the protection afforded to boilers, economizers and steel tubing in keeping them free from corrosion, the power plants of this great army headquarters will continue to function without "outage" for repairs to corroded steel equipment. Cochrane Deaerators supply oxygen-free feedwater on a guaranteed basis.

COCHRANE CORPORATION • 3123 N. 17th ST. • PHILADELPHIA 32, PA.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

A reproduction from an actual unretouched color photograph which illustrates the appearance of the Pyrex Broad Red Line Gauge Glass from directly in front.

What determines Gauge Glass life?

The life of a Gauge Glass depends upon the glass from which it is made, the precision with which it is manufactured and the installation.

A PYREX brand Gauge Glass will withstand the shock of temperature changes that would instantly shatter an ordinary gauge glass. It resists the chemical attack of steam and, therefore, retains its transparency. Special machines draw these gauge glasses to uniform accuracy which reduces installation to a very minimum.

That is why you can depend upon PYREX Gauge Glasses to give long time service.

Corning Standard Gauge Glass

Corning Standard Gauge Glasses

For low pressure service specify CORNING Standard Gauge Glasses. They are made to the same precise tolerances as are PYREX High Pressure Gauge Glasses.

Stocked by all leading steam and mill supply houses.

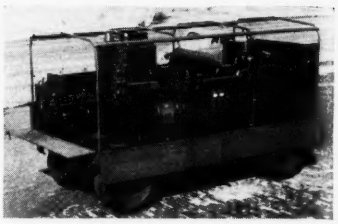
"PYREX" and "CORNING" are registered trade-marks and indicate manufacture by Corning Glass Works

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

BACK THE ATTACK

WITH WAR BONDS

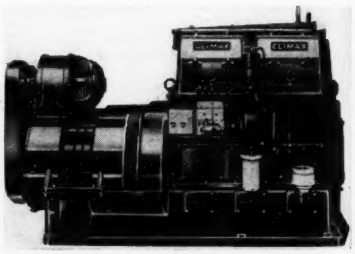


process is controlled by thermostats, and when the proper temperature is reached, the oil is dropped into a transfer tank, then forced through a two-stage filter by compressed air and out to clean oil receiving drums.

The reclaimers are built in eight sizes to meet any requirements for the purification of dirty lubricating oils from Diesel, automotive and aircraft engines, as well as for hydraulic, vacuum pump, and transformer oils.

Climax Engineering Co. Begins Diesel Production

TWO SOLID-INJECTION, compression-ignition Diesel engines are now being produced by Climax Engineering Co. of Clinton, Iowa, in addition to its line of 8 to 480 hp gas engine generating sets. Both new engines are 4-cycle, full Diesels, and intended for use as light plants and as drives for pumps, compressors, mills, mine equipment, marine service, etc.



Model D148 is a two-cylinder unit with a maximum rating of 22 hp. It may be equipped for pulley drive with or without clutch or clutch and reduction gear or auxiliary power take-off. It may be direct connected, on a single base, with a 15-kva generator.

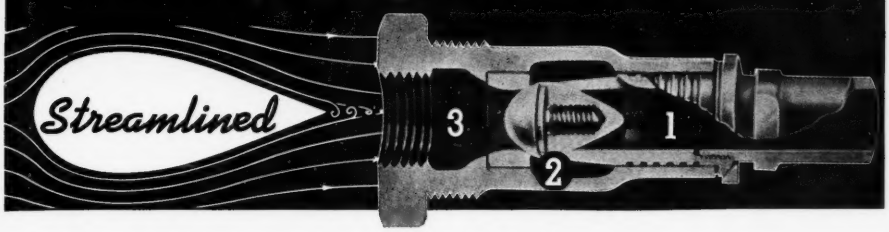
Model D297 is a four-cylinder unit with a maximum rating of 44 hp. Drive equipment similar to Model D148 may be furnished. A special feature of D297, however, is that a flywheel, clutch, generator or marine gears may be installed on either or both ends, provided a radiator is not used. For electric power and light, the D297 may drive a 30-kva generator.

Among the features that make Climax Diesels reliable, low cost power plants are:

The new engines are built with one-piece crankcase and cylinder housing, replaceable chrome nickel iron cylinder liners, water cooled exhaust manifold, and are simply designed for accessibility. Space requirements are: D148 engine and equipment—46 in. by 32 in.; D148 engine and generator—76 in. by 32 in.; D279 engine and equipment—66 in. by 32 in.; D279 engine and generator—92 in. by 32 in.

STRAIGHT LINE FLOW

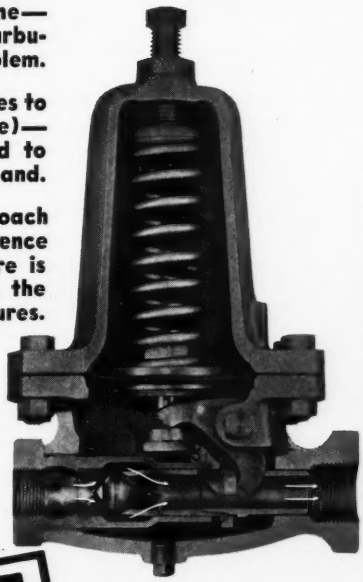
- *to insure maximum capacity*
- *for close delivery pressure control*
- *to save operating and maintenance cost*



1 **Straight Line Flow: Steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence—therefore, peak flow is never a problem.**

2 **Inner valve is streamlined—no back eddies to hinder flow (see streamlined form above)—valuable when you want all possible fluid to go through the valve to meet peak demand.**

3 **Turbulence eliminated by venturi approach to the valve seat. This eliminates turbulence—it means better flow. The inlet pressure is confined to a small cylindrical chamber, the same being advantageous for high pressures.**



★ The "1000" valve is single seated and its valve makes line contact with its seat ring which accounts for its tight closing characteristics. The unusually long diaphragm spring insures sensitive pressure control.

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

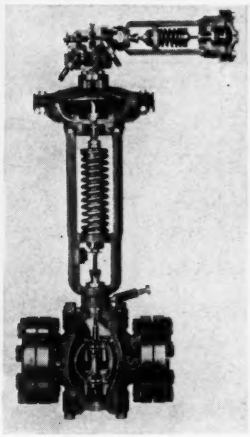
- Trouble-free service
- Smooth operation
- Tight closure
- Accurate regulation
- Elimination of failures
- Constant delivery pressure
- No spoilage
- Maintenance needs practically zero
- Speedier production results
- Cost-saving operation

Write for Bulletin 1000 to get details on this Streamlined Valve for smooth even flow of steam, water, air, oil, etc.

CASH STANDARD CONTROLS.. VALVES

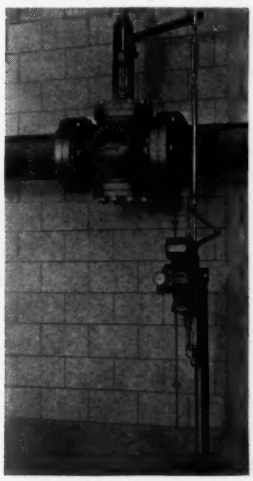
A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

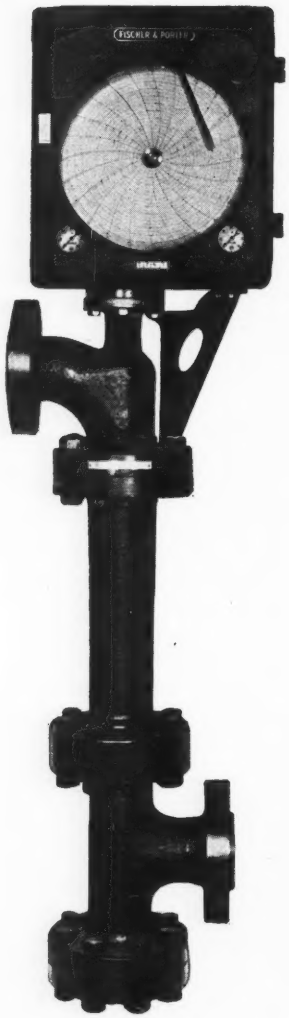
Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.



The Cash Standard Type 100 Controller above is operating an 8" Type 42-R Balanced Valve, automatically reducing 250 lbs. down to 125 lbs. pressure, handling 200,000 lbs. steam per hour.

Type 100 Controllers have lots of operating power, enough for any size valve; are fully compensated; have adjustable range; are very sensitive. Bulletin 963 covering the Controller and Bulletin 965 covering the Valve give complete and interesting details. Write for them.

For positive control of continuous blow-down



A NEW way for you to prevent heat waste by accurately controlling the flow rate of continuous blow-down is available in the latest Fischer & Porter development, the Magna-Bond Rotameter. This meter is all metal (no glass) and is completely enclosed. The position of the rotameter float is indicated externally by means of a permanent magnetic clutch. The Magna-Bond may be obtained as a plain flow rate indicator, or as recorder, or recorder-controller. It may also be equipped with our new high accuracy Magna-Count integrator for totalizing the flow. The interesting details are all given in our latest bulletin on recording and controlling rotameters, No. 50-A. Just write if you wish a copy.

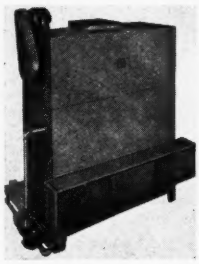
You will be able to see our latest development at Booth 304-306—CHEM SHOW, NEW YORK, DEC. 6 to 11.

FISCHER & PORTER CO. 5911 County Line Road HATBORO, PA.

Evaporative Condensers with Built-In Air Filters

EVAPORATIVE CONDENSERS with built-in air filters, to protect against impurities in the cooling system, are now available in the Wat-R-Miser units of Drayer & Hanson, Inc., Los Angeles, Calif.

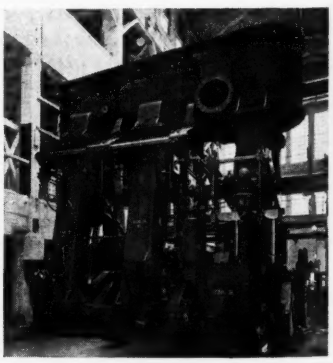
The manufacturer states that proper filtering of the air eliminates or greatly reduces clogging of lines due to impurities in the system, plugged spray nozzles, excessive head pressures and pump maintenance.



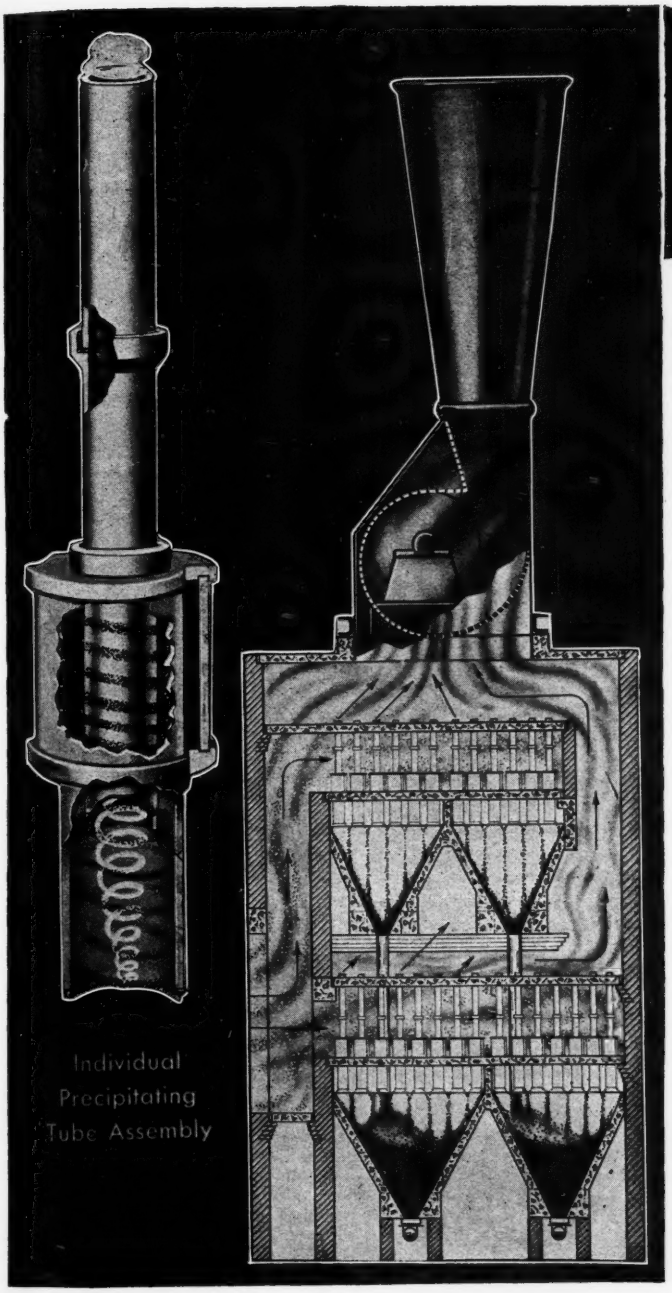
The new air filter feature is standard equipment on all models in capacities of five to 100 tons. The filter is all metal, built to be removed easily and washed or cleaned when necessary.

Triple Expansion Marine Engines

IRON FIREMAN MANUFACTURING CO. is now one of the three largest builders of triple expansion marine engines in the United States. Two months after Pearl Harbor Iron Fireman took over an empty building, obtained machinery and machinists both of which were at a premium in war industry centers, and delivered its first engine for use on Liberty ships within five months.



These engines weigh 270,000 lb, have a stroke of 48 in. and have cylinders which range from 24½ in. in diameter in the high-pressure-cylinder and 37 in. in diameter in the medium-pressure-cylinder to 70 in. in diameter in the low-pressure-cylinder. Iron Fireman is carrying on its production of commercial and industrial coal stokers in its plants in Portland, Cleveland, and Toronto. Besides the marine engines, its war production includes airplane parts, machine gun mounts, and hundreds of parts for army ordnance.



Double Deck Arrangement

PRAT-DANIEL CORPORATION, Port Chester, N. Y.

General Sales Agents

THERMIX ENGINEERING CO., GREENWICH, CONN.

Representatives in Principal Cities

NO CORROSION IN THERMIX CERAMIC DUST COLLECTOR

Non-Priority Type

Low temperature gases containing sulphur do not affect the **fire clay** tubes now used in Thermix CERAMIC Dust Collectors instead of **steel** tubes. Neither do high temperature gases affect them.

These fire clay tubes are even harder than steel, yet they weigh no more.

One advantage of these practically indestructible tubes is that they make it possible to install this Dust Collector outside of the plant, if desired, without any additional protecting structure.

Another advantage is that Thermix CERAMIC Dust Collectors can be installed right now without a priority, because they are constructed of non-critical materials.

In spite of the non-critical materials used, this new Thermix Dust Collector retains all the features which have resulted in the high efficiency of the Thermix Steel Dust Collectors now used for collection of fine dusts, powders and fly-ash in connection with over 40,000,000 lbs. of steam capacity per hour.

Write for bulletin and full particulars, or mail the coupon.

Thermix Ceramic DUST COLLECTOR

THERMIX ENGINEERING CO.
First Natl. Bank Bldg.,
Greenwich, Conn.

Without obligation on our part, you may send details about the Thermix Ceramic Dust Collector.

NAME .....

ADDRESS .....

CITY ..... STATE.....

HINTS ON HOW TO PROLONG
JOURNAL BEARING LIFE

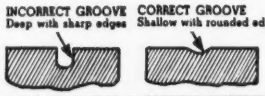
There are five principal causes of bearing failures: (1) use of wrong bearing metal, (2) improper oil-groove design, (3) faulty bond between shell and lining, (4) incorrect or insufficient lubricant and (5) presence of foreign particles in the oil. All can be overcome readily by applying normal precautionary methods. Here are a few suggestions.

BOND

A good bond between shell and lining is very important . . . to prevent lining from cracking or loosening. Complete tinning is required to hold linings fast to shells. Anchor grooves are helpful where tinning is inadequate. Write for particulars of Magnabond System for fuse bonding.

OIL GROOVES

A good groove and chamfer arrangement produces a wedge action which forces lubricant around and under the shaft. Sharp grooves break the oil film . . . rounded edges feed oil to the journal.



LUBRICATION

Whenever possible, bearing housing should be flushed out with kerosene, and dirt removed with compressed air, about once a year. Remove all flushing oil before fresh oil is added. Consult local lubrication engineer for lubricant to be used.

INSPECTION

Tightness of bearing should be checked every six months, as a loose shaft causes power loss and excessive bearing wear. Do not permit shaft to rub housing. When lining becomes badly worn, reline bearing at once.

BEARING METAL

Most important point of all is selection of bearing metal. 90% of bearings in use today are subject to uniform speed and only moderate pressure, as in electric motors, line shafting and general machinery. For such services, use Magnolia Anti-friction Metal.

When bearings must stand heavy, sustained pressures, such as in rolling-mill machinery, use Pyramid, a hard metal which will not squeeze out.

For shock loads, which would crack the harder metals, use Defender, a tough yet malleable metal. Internal combustion engines and trap rock crushers are typical applications.

GENERAL USE

HEAVY LOADS

SHOCK LOADS

NEW BULLETIN

Write for FREE 8-page bulletin which gives many helpful hints on how to make bearings that will last . . . you will be under no obligation.

MAGNOLIA METAL CO. . ELIZABETH, N. J.

MAGNOLIA BEARING METALS

OBITUARIES

J. E. Brobst

J. E. BROBST, general consultant of the industrial control engineering division of the General Electric Co., died in Schenectady on September 30 after a brief illness. Mr. Brobst had been associated with General Electric for 40 years and is credited with many important contributions to the development of industrial control equipment.

Mr. Brobst was a native of Mondovic, Wis., graduated from the University of Wisconsin in 1903, joining G-E's motor design department at the Schenectady plant that same year. Later he became a design engineer in the industrial control department.

He was made manager of the company's Bloomfield, N. J., plant in 1929, but returned to Schenectady a year later to head the industrial control engineering department as managing engineer. He continued in this post until January 1, 1943, when he was appointed general consultant to the department.

George C. Sawyer

GEORGE C. SAWYER, a director of the Ebasco International Corp., formerly the Electric Bond & Share Co., died September 20 at his home on Beach Terrace at Pines Lakes. He was fifty-six years old.

Mr. Sawyer was a utility executive during most of his business career. He was formerly an officer of the Montpelier Light & Power Co., of Montpelier, Vt.; district manager of the Pacific Light & Power Co., at Yakima, Wash., and assistant general manager of the latter company's Pacific system with headquarters in Portland. He joined the Electric Bond & Share Co. in New York in 1929.

Charles P. Teeple

CHARLES P. TEEPLE, Vice-President and Director of Research of the Crane Packing Co., who died recently as the the result of an accident, pioneered numerous improvements and was widely recognized for his notable contributions to the mechanical packing industry's development.

Mr. Teeple held a doctor's degree in metallurgy from the University of Michigan and was a member of the Society of Automotive Engineers and Illuminating Engineers Society.

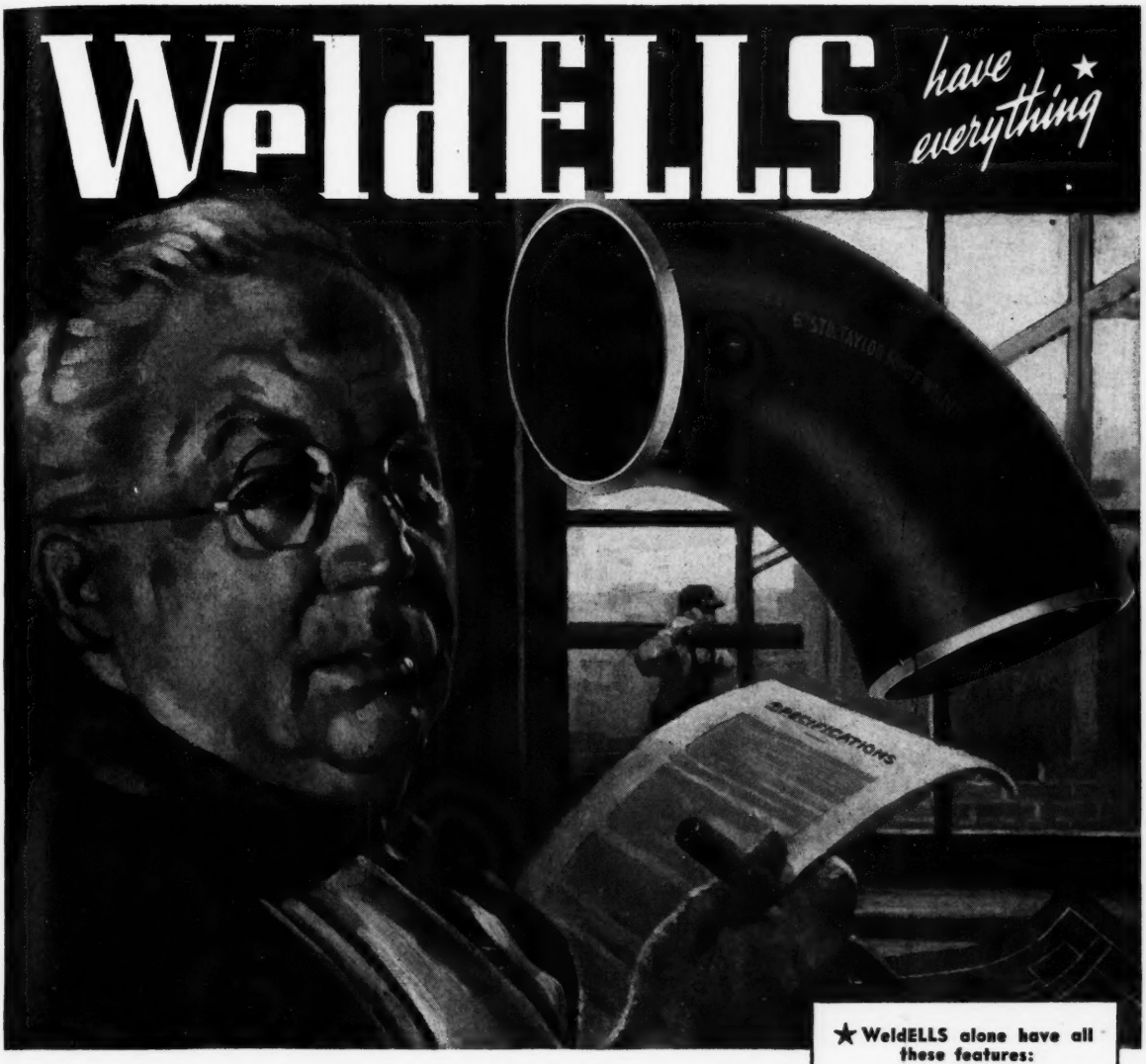
Stuart J. Saks

STUART J. SAKS, President of Morris Machine Works, Baldwinsville, N. Y., died on Sunday, Sept. 5, 1943, at the age of 52 years. He was a veteran of the first World War and head of one of Onondaga county's largest industries outside of Syracuse. Mr. Saks was born at Blossville, Pa., and went to Syracuse as a youth and received his college education at Syracuse university.

He was a captain in the Second U. S. Cavalry during the last war but was known best for his service after the Armistice as assistant provost marshal in Paris. With headquarters in Rue de St. Anne, he handled the cases of all American soldiers found A.W.O.L. in the French capital.

Following the war, Mr. Saks was in newspaper work for a time and served with International News Service in New York and the Associated Press in Pittsburgh. He then turned to manufactur-

WeldELLS have everything ★



"In my business little things make a big difference!"

ON the surface a piping contractor's work looks simple: Just size up the specs and figure out a bid that will take the job!

But that's only the way in. If you want to do a good job and come out right on it, you've got to make every move count. And you can't do that unless you're working with the right kind of stuff.

Take welding fittings: If WeldELLS* are specified I know the job will *move.* It will move because those permanent markings of size and weight on every fitting stop the groping, the false starts and the mistakes—because those accurate quarter-markings help to guide the work—because the tangents make lining up easy—because the bright, lathe-cut bevels enable the welder to do a better job faster.

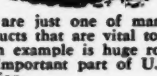
When I say this, I'm not overlooking the specifier's end of the job, either. It seems to me that any engineer will concede that WeldELLS are *more* than "equal" to any other fittings on a purely engineering basis.

For better welded piping at lower cost give me WeldELLS—the welding fittings that have *everything!*

* WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

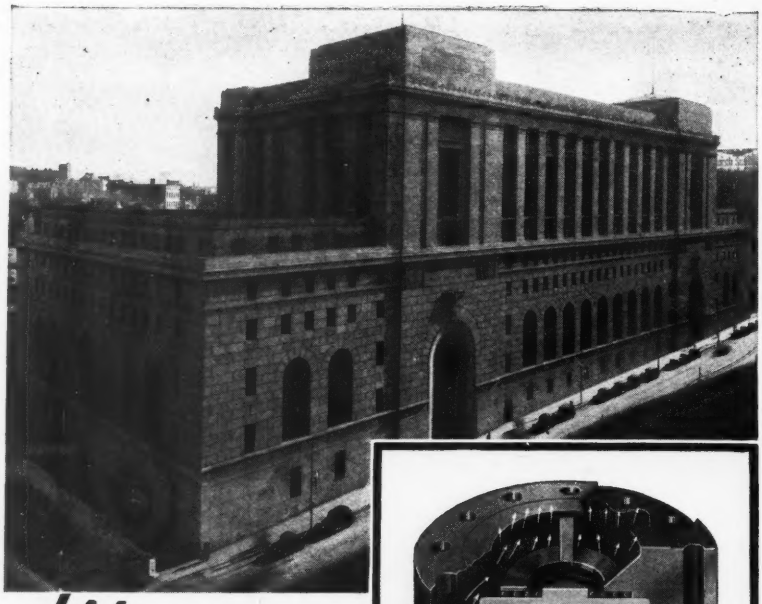
★ WeldELLS alone have all these features:

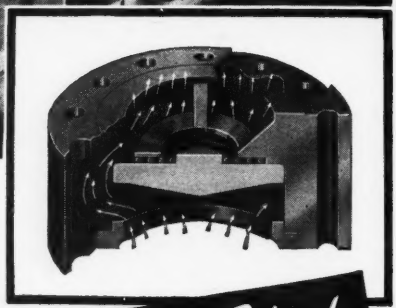
- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.



WeldELLS are just one of many Taylor Forge products that are vital to war and victory. An example is huge rolled steel rings—an important part of U. S. tanks now in action.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING





WILLIAMS-HAGER

FLANGED *Silent* CHECK VALVES

Williams-Hager Installations Include:

U.S. Federal Courts and P. O., Pittsburgh, Pa. (Above)

Tennessee Valley Authority, Fontana, N.C.

Statler Hotel, Washington, D.C.

Mellon Art Gallery, Washington, D.C.

Radio City New York City

Kaiser Co., Inc., Fontana, Calif.

Standard Oil (Indiana) Whiting, Ind.

Tight under *every* condition of service and pressure—WILLIAMS-HAGER Flanged Silent Check Valves assure unrestricted and uninterrupted flow of liquids. No webs to hamper flow . . . operates in any position . . . and of simple, compact design.

Available in iron, semi-steel, bronze, cast steel, stainless steel or monel . . . 1″ to 20″ inclusive, pressure resistant to 6000 pounds.

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

Write for this interesting brochure

3000 Pennsylvania Ave., Pittsburgh 12, Pa.

ing and had executive positions with several companies before he joined the Baldwinsville company about three years ago.

Mr. Saks was made president of the Morris company two years ago, directing it in increasing activities as it became busy with war work.

He also was active in the civic life of his community.

MANUFACTURERS' PERSONALS

American Locomotive Co. has announced the appointment of Lawrence B. Jackson as Director of Engineering, Diesel Division, effective October 1. Mr. Jackson is a graduate of Stevens Institute of Technology, has had a wide range of experience in the internal combustion engine field and has contributed to various technical journals on subjects relating to internal combustion engines. He is the inventor of an interlock hydraulic control for water gas manufacturing and an exhaust silencer.

Cochrane Steam Specialty Co., Boston, Mass., announces the addition of Joseph B. Grinnell to its organization. Mr. Grinnell is a former associate of The Whitty Manufacturing Co., and has also been connected with the electrical staff of one of the large Army installations in New England. The Cochrane Steam Specialty Co. represents, in New England, the Cochrane Corp., the Hays Corp., the Reliance Gauge Column Co., the Northern Equipment Co., The Roto Co., the Wheelco Instruments Co., the Buffalo Meter Co., the American Arch Co., the Taylor Instrument Cos., the Vulcan Soot Blower Corp., and the Fairfield Engineering Co.

Cutler-Hammer, Inc., of Milwaukee, Wis., has announced the appointment of W. E. Addicks as manager of its New York District Office. In his new duties Mr. Addicks will have direct supervision of sales for the company in the entire New York sales territory. Mr. Addicks entered the employ of Cutler-Hammer, Inc., as an engineer immediately after he graduated from Cornell University in 1914, and for ten years he served as chief engineer at the New York works. Prior to his new appointment Mr. Addicks was in charge of the Boston Sales Office.

Robert J. McKay has been elected chairman of the American Society for Testing Materials Committee B-8 on Electrodeposited Metallic Coatings. This committee was formed in 1941 because recognition of the corrosion resistance and other valuable properties of properly controlled electrodeposits had raised many questions in American Society Testing Materials Committees dealing with iron and steel, non-ferrous metals and with corrosion, and it was agreed that a permanent standing committee on electroplating would simplify the Society's work in setting up specifications, recommended procedures and test programs. Mr. McKay is chemical engineer, Nickel Sales Department, the International Nickel Co., Inc., and is closely connected with activities in electroplating. He has been elected to serve during the unexpired term of the late Professor E. M. Baker of the University of Michigan.

AMONG the many progressive stations taking advantage of better coal sizing to improve boiler performance and effect worth while coal savings is the Springdale Plant of West Penn Power Co.

Here, two AMERICAN Type 38-S Crushers reduce coal from run of mine to screenings—properly size it at the rate of 200 tons per hour each—and at a total cost of less than a penny a ton, including maintenance, power, labor and depreciation and interest on investment.

"AMERICANS" differ from other centrifugal crushers in that their housings are heavy steel castings reinforced with ribs that make them unbreakable from any crushing strain.

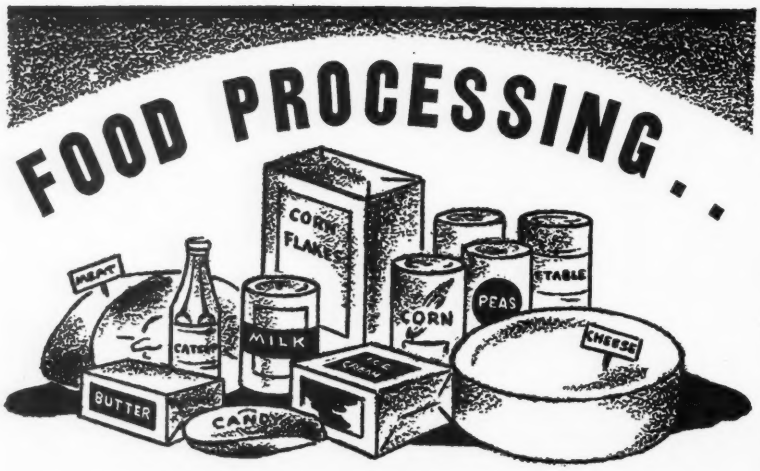
Then, too, in the "AMERICAN" coal is actually SPLIT rather than crushed. This result is achieved through a reversible manganese steel Shredder Ring — an exclusive "AMERICAN" development which makes it possible, by a simple adjustment, to size coal for top economy with stoker or pulverized fuel.

Your plant, too, can undoubtedly benefit by the use of AMERICAN Ring Crushers for better coal sizing. Complete performance data, together with a list of users in industrial plants or central stations like yours, will be sent on request.

Found Only In AMERICAN CRUSHERS!

This reversible Manganese Steel Shredder Ring is a patented feature only found in American Rolling Ring Crushers. It splits the coal instead of crushing it which assures a uniform size of crushed coal. An adjustable grinding plate makes it possible to obtain properly sized coal for either stoker or pulverized use. The crusher can be adjusted to make a maximum or minimum amount of fines. . . . .

AMERICAN PULVERIZER COMPANY
1429 Macklind Avenue
St. Louis, Missouri
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS



an AMERICAN INDUSTRY *that is helping keep ours the* BEST FED NATION *in the* WORLD

In spite of being hampered by manpower, equipment and supply shortages, the food processing industry is nevertheless coming through with more food than has ever been processed in the history of our nation.

While many new plants mushroomed and much new equipment was installed, the bulk of this record-breaking production was accomplished by demanding more work from equipment that had been installed before "Pearl Harbor."

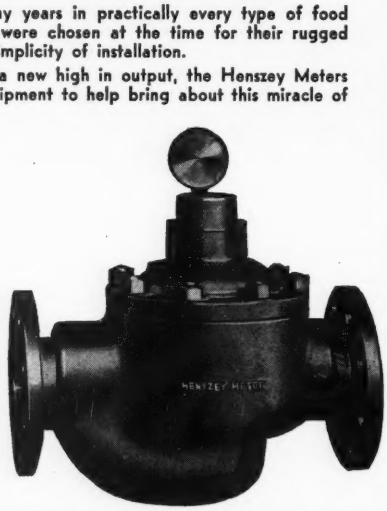
HENSZEY FEED WATER METERS

for example have been in use for many years in practically every type of food processing plant in the country. They were chosen at the time for their rugged construction—their accuracy—and for simplicity of installation.

When the demands of war required a new high in output, the Henszey Meters did their part along with the other equipment to help bring about this miracle of production.

If you have a liquid measuring problem in your war work, consider Henszey Meters. They accurately measure boiler feed water, boiler blowdown, condensate, free running chemicals and other hard-to-measure liquids. They are equally accurate at high or low flow—high or low pressures—on reciprocating or centrifugal pumps. Calibrations can be made to read in gallons, pounds or cubic feet at any specified temperature. The entire meter is easily installed right in the line.

Write today for full information—stating the details of your problem will save time.



Sizes from 10 g.p.m. to 1200 g.p.m. cold water steady flow rating. Pipe connection ¾" to 6"—special sizes to order.

HENSZEY CO.
Dept. C11
Watertown, Wis.

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Flow Indicators • Boiler Feed Regulators • Proportioning Valves

Eric E. Backlund has been made sales manager of Goulds Pumps, Inc., Seneca Falls, N. Y. Mr. Backlund came with the company in 1923, two years later joined the export department and until 1932 traveled extensively in Central and South America. He was then made manager of Goulds' Philadelphia office and served in that capacity until he returned to the headquarters office in 1935 as assistant sales manager, which position he has held until his present post.

Jenkins Bros. has appointed Alfred M. Street publicity manager in which capacity he will direct the advertising of all the company's products. Mr. Street has been associated with Jenkins Bros. for the past 12 years, first in Bridgeport, Conn., where the valve plant is located, and for the past seven years in the firm's New York office. In his new position he succeeds Charles C. Chamberlain who has been made general sales manager.

General Electric Co. has announced the appointment of Howard W. Bennett as manager of the Specialty Division of the company's electronics department. In this capacity Mr. Bennett will be responsible for the engineering, manufacturing, and sales operations of that division.

E. H. Howell, manager of General Electric's Toledo office for the past 13 yr, has been appointed manager of the company's meter and instrument division as of September 1, according to an announcement by H. V. Erben, manager of the G-E Central Station Division. Mr. Howell succeeds W. F. Howe, a veteran of 43 years' service, who is relinquishing his responsibilities but will continue as a full-time consultant of the division.

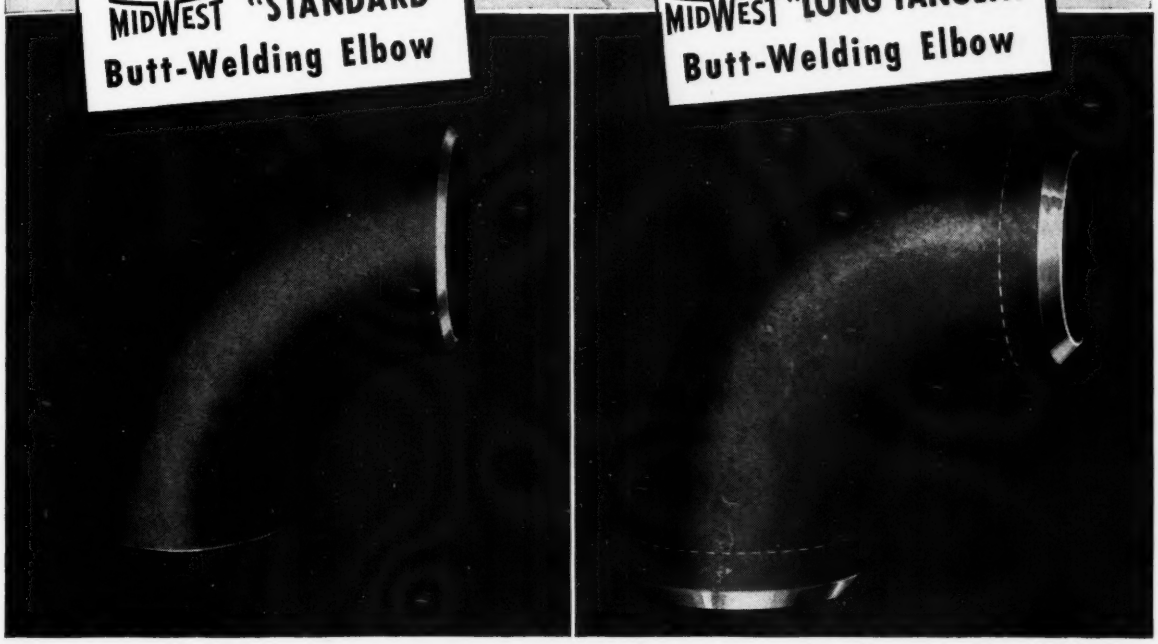
Simultaneously, it was announced by L. T. Blaisdell, G-E commercial vice president at Cleveland, that S. J. Tombaugh of that city had been named manager of the company's Toledo office, succeeding Mr. Howell.

Harry A. Erb has joined the Worthington Pump and Machinery Corp. organization as service manager of the Moore Steam Turbine Division, Wellsville, New York. His experience covers the servicing of steam turbines, electric generators and all related equipment since his graduation from Cornell University in 1928.

Richard P. Brown, chairman of the board of the Brown Instrument Co., and vice president of Minneapolis-Honeywell Regulator Co., who for the past 18 months has been serving as regional consultant to the Defense Plant Corp., subsidiary to the RFC, has been named deputy director of the War Production Board, Third Region. Mr. Brown's new duties will include maintenance of maximum production in plants engaged in war work in coordinating of efforts in the production drive of the Labor and Management Consultation Division of WPB in Pennsylvania, New Jersey, Delaware, Maryland and Virginia. He will act as liaison officer on all manpower problems in which WPB is interested.

Thomas I. Phillips, Vice President of the Westinghouse Electric and Manufacturing Co., has been appointed head of the company's Pittsburgh divisions. Mr. Phillips succeeded A. C. Streamer who was named Assistant to the President with headquarters in Pittsburgh.

Only MIDWEST OFFERS YOU THIS CHOICE



The difference between the two types of welding elbows shown above is in their dimensions. The "American Standard" elbow has a center-to-end dimension equal to one and one-half times the nominal pipe size. The Midwest "Long Tangent" elbow has tangents (straight ends) equal to one-fourth of the nominal pipe size; the center-to-end dimension is one and three-quarters times the nominal pipe size. Important among the advantages of the long tangents are: (1) pipe and fitting more quickly and accurately lined up, (2) weld removed from point of maximum bending stress, (3) less pipe required, (4) short nipple and extra circumferential weld frequently eliminated, (5) slip-on welding flanges easily used, etc. There is no increase in price for Midwest "Long Tangent" Welding Elbows.

Both types of elbows have all other advantages that result from the unique Midwest manufacturing process: final working of metal in compression (which means exceptional dimensional accuracy and uniformity), stress relieving, exact included angle, true circular cross-section and uniform wall thickness. For all the facts about Midwest Welding Fittings, ask for Bulletin WF-41.

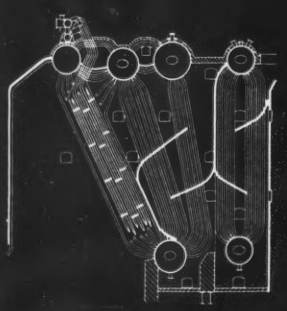
MIDWEST PIPING & SUPPLY CO., INC.

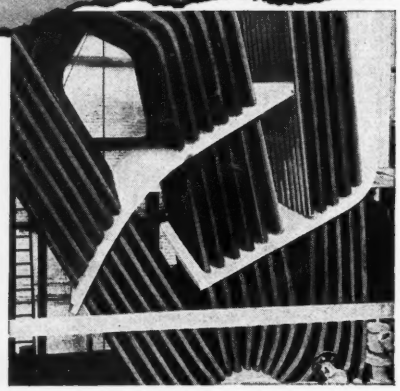
Main Office: 1450 South Second St., St. Louis 4, Mo.

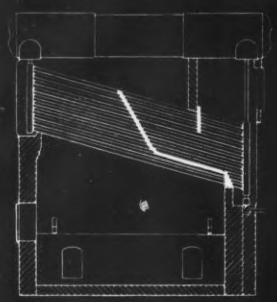
Plants: St. Louis, Passaic (N. J.) and Los Angeles

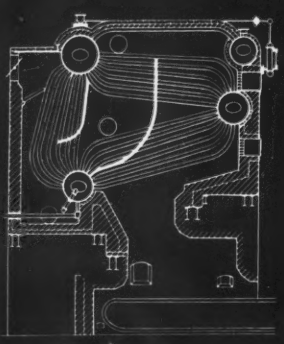
Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • Tulsa—533 Mayo Bldg.

GET MORE STEAM by Streamlining









Streamline the cross-flow of gases over your boiler's heating surfaces and you increase steam output. It's as simple as that with Enco Baffles installed in your boilers.

Scientifically tapered gas passes and curved baffle surfaces put every square foot of heating surface to work, maintain efficient gas velocity, eliminate bottlenecks, eddy currents, dead gas pockets.

Draft losses reduced. Less steam needed for cleaning, because soot blowers work more effectively—and need be used less often with Enco Baffles.

Applicable to any design of water-tube boiler, fired with any type of fuel. Every installation individually designed on the basis of 25 years' experience in this highly specialized branch of engineering. Installed by skilled mechanics, using selected materials.

Write for ***BULLETIN BW40***

FREE

Gives important data on modern baffle construction

THE ENGINEER COMPANY

75 WEST STREET • NEW YORK 6, N. Y.

Enco Streamline Baffles

PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY

A year after he came to Westinghouse as a tool maker in 1915, Mr. Phillips was made a foreman and in 1919 he was transferred to East Pittsburgh for time study work in the Railway Department and the Copper Mill. In rapid succession he advanced through various executive and management positions in the factories and in February, 1941, he was named Assistant to the President in charge of a headquarters manufacturing staff with supervision over several important divisions of the company. Mr. Phillips was elected Vice President of the company in November, 1941.

MANUFACTURERS' NEWS

Army-Navy "E" Awards

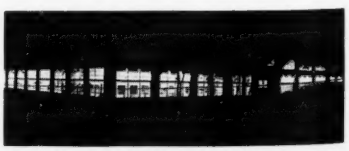
Cutler-Hammer, Inc.*
Milwaukee, Wis.
Fitzgibbons Boiler Co., Inc.
New York, N. Y.
The Fulton Sylphon Co.*
Knoxville, Tenn.
Link-Belt Co.
Caldwell Plant, Chicago.
Philco Corporation*
Philadelphia, Pa.

Maritime Commission "M" Awards

Iron Fireman Mfg. Co.*
Portland, Oregon.
Jenkins Bros.*
Bridgeport, Conn.
Trill Indicator Co.*
Corry, Pa.

*Star added for sustained high achievement in production of war equipment.

The Ohio Injector Co. has recently completed and placed in operation a large new manufacturing plant at Wadsworth, Ohio, for the large scale production of the new OIC cast steel valves. This plant, which contains a quarter of a million square feet of floor space, is equipped with the most modern precision equipment and is now in full production with 'round the clock schedules to meet all demands.



Production includes the complete range of gates, globes, angles and checks in the 150 psi series, with the 300 psi series soon to be in production. This is to be followed by the manufacture of valves in the 400 and 600 psi classes. All of these valves embody an important and patented OIC feature permitting easier and speedier repacking under pressure.

Installed By the Thousands DURING 1942-1943 IN —

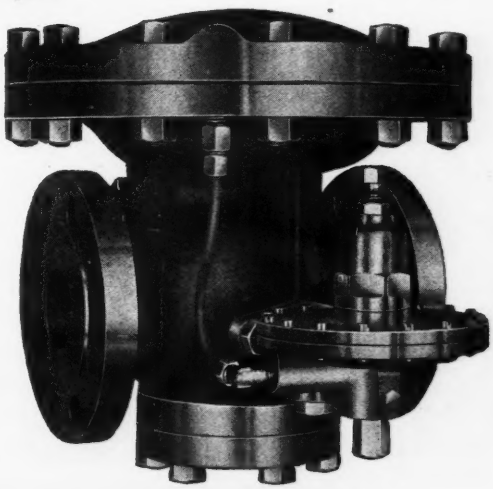
POWDER PLANTS . . . ORDNANCE PLANTS . . . PROVING GROUNDS . . . POWER PLANTS . . . ARSENALS . . . ARMY CAMPS . . . NAVAL BASES . . . CHEMICAL AND PROCESS PLANTS

FISHER Type 92 For Better Steam Pressure Control

Think of every feature you want in an automatic controller for steam pressure — and you'll find the answer in a Fisher Type 92.

IT'S ACCURATE . . pilot control is extremely sensitive to flow changes and maintains desired reduced pressure. IT'S FLEXIBLE . . two pilot assemblies for high or low pressure service, easily adjusted to your requirements. IT'S STURDY . . high-tensile bodies and diaphragm casing of rugged ribbed construction — inner parts Duromite bronze, stainless steel or special as ordered. IT'S COMPACT . . and has unusually large capacity. 10 sizes, ½" to 2" screwed or 1" to 6" flanged. No special wrenches needed for servicing.

These are the reasons why power engineers prefer the Fisher Type 92 — and why they have chosen the Type 92 for literally thousands of installations. Write for Bulletin C1.



Fisher Type 92 — equipped with low pressure pilot. High pressure pilot available and interchangeable.

ARMY E NAVY

FISHER GOVERNOR COMPANY

• 1017 FISHER BUILDING •

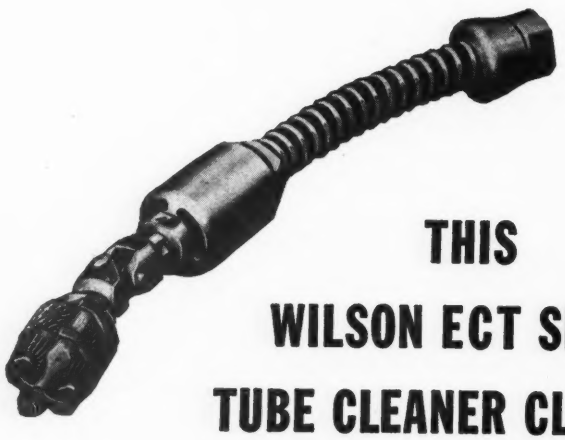
MARSHALLTOWN, IOWA

Robert A. Emmett, President and Chairman of the board of Detroit Rex Products Co., metal cleaning engineers, has announced that Detrex Corp. replaces Detroit Rex Products Co. as the new firm name. Ownership, company policy and management will remain unchanged. The trade name "Detrex," a word now widely recognized in the metal cleaning industry, is therefore particularly significant in the new title.

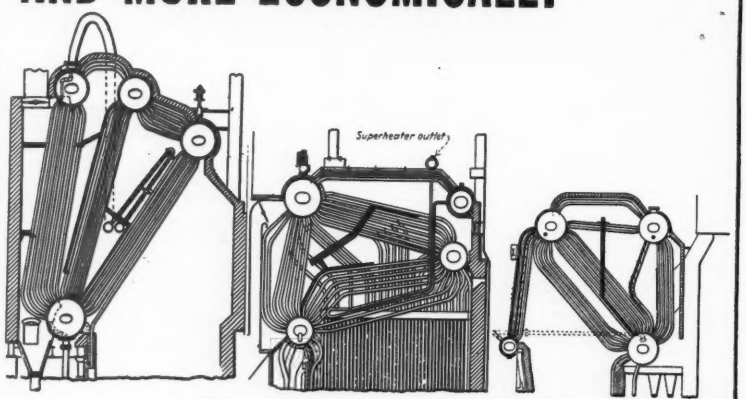
Shell Chemical Co. has merged with its parent corporation, Shell Union Oil Corp. The business formerly conducted by Shell Chemical Co. will be continued by the Shell Chemical Division of Shell Union Oil Corp.

Tube Turns, of Louisville, Ky., has opened two new West Coast offices. T. H. Pike, Jr., district manager for the Pacific Coast area, is now located at 2611-12 Russ Building, San Francisco. Since October 15 a second office has been maintained in Room 422-A, Smith Tower Building, Seattle 4, Wash. In this office John M. Hartley, formerly of the Los Angeles office, will handle matters pertaining to Washington, Oregon, and British Columbia. The Los Angeles office was closed October 15.

Welded tubing manufacturers who make tubing for heat transfer apparatus consider it advisable to mark each length of welded tubing that is produced for this use with a suitable symbol. Each manufacturer has an individual symbol to use in this way for identification of his product. A chart, copies of which are available from the Formed Steel Tube Institute, Cleveland, Ohio, has been prepared showing the symbols of all companies who manufacture welded steel tubing for heat transfer apparatus and who are reported as having adopted this identification procedure.



THIS
WILSON ECT SERIES
TUBE CLEANER CLEANS
ALL BENT TUBES BETTER, FASTER
AND MORE ECONOMICALLY



Send for a Copy of our 40-page Catalog

BACK THE ATTACK! BUY WAR BONDS AND STAMPS!

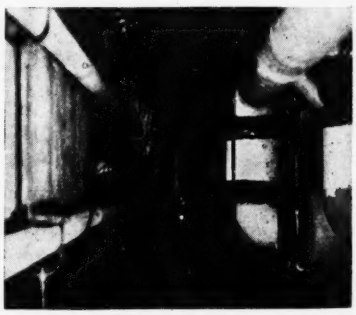
THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
THE WILSON BUILDING
21-11 44TH AVE. LONG ISLAND CITY, N. Y.

NEWS FROM THE FIELD

Steam for New Kropp Forge Plant

AT THE NEW DROP FORGE plant of Kropp Forge Aviation Company, built for the mass production of airframe drop forgings, a boiler plant has been installed to generate steam for the drop hammers and all piping for distributing it through the plant is installed in a pipe tunnel. This gets the piping out of the way of cranes and other equipment but leaves it fully accessible for maintenance and alterations.

The new power plant contains three 611-hp water-tube boilers, operating at 120-160 psi pressure, generating steam for the drop hammers, which range from 3,000 to 20,000 lb in rating. The exhaust steam is used for plant heating and boiler feed. The boilers are equipped to burn either gas or oil. Gas is burned in summer, when it is more economical under local seasonal rates, and oil is burned in winter when the reverse is true. A modern water treating system is included in the power plant's equipment, and all operations are checked by flow meters and other approved control devices.

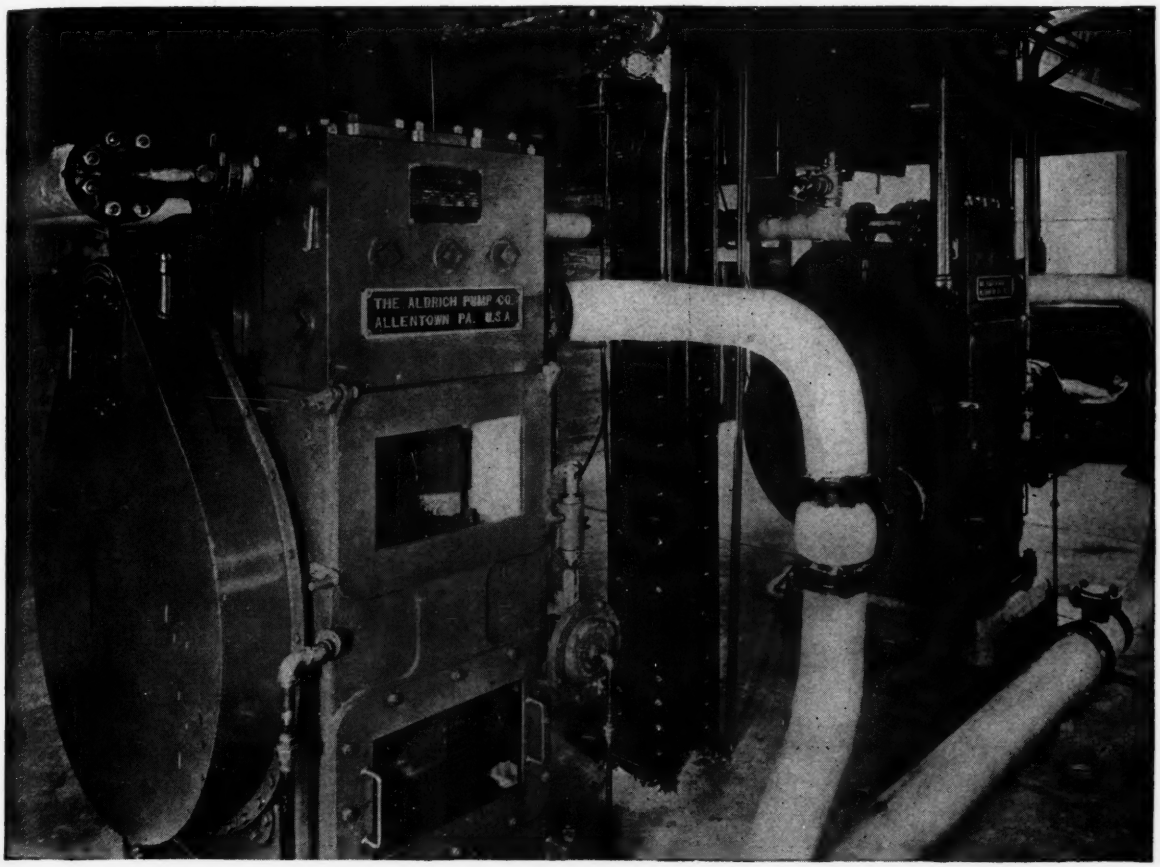


View in main pipe tunnel of Kropp Forge Aviation Co.

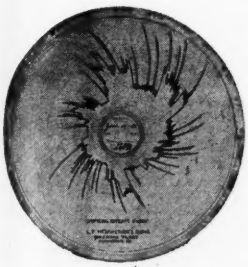
The pipe tunnel, a view of which is shown, is 6 ft 6 in. square in cross-section. An 8-in. main steam pipe line, with heavy asbestos-magnesia insulation and suitable expansion joints, conducts the high-pressure steam through the tunnel to the forge shop, where it is distributed to the drop hammers through branch lines. The return line to the boiler house is a 14-in. pipe, likewise insulated. A 4-in. air line carries compressed air through the tunnel to the hammers, air lifts, scale-blowing equipment, the grinding shop, and to the inspection department, where it is used in connection with the Magnaflux equipment. Air cleaners or separators are installed in this line to provide clean, dry compressed air for all applications. Two oil lines—feed and return—each 2 in. in diameter, carry oil to the forge shop furnaces, which are combination oil and gas-burning.

THESE ALDRICH-GROFF "POWR-SAVR" PUMPS...

TRADE MARK



...hold boiler water levels to close limits!



Typical Steam Flow Chart for a 24-hour period showing the widely varying steam demands from boilers fed by Aldrich-Groff Controllable Capacity "Powr-Savr" Pumps in a large eastern brewery.

EVEN with the widely fluctuating steam demands as indicated in the steam flow chart at the left, two ALDRICH-GROFF Controllable Capacity "Powr-Savr" Pumps have automatically maintained boiler water levels within one inch of the desired point as consistent practice during the more than 2 years of their operation to date. Each of these 0-to-4" *variable-stroke* vertical triplex pumps is driven by a 20-HP constant speed motor and feeds one 40,000-lb. per hr. boiler, with power consumption almost directly proportional to pump delivery.

The use of these pumps with *unit feed systems* eliminates the pressure and power losses associated with throttling-type feed-regulating valves. The pump offers the advantages of feed system simplicity, efficiency and mechanical reliability for the small and medium boiler plant using medium and high steam pressures, and for *de-superheater feed service* in even the largest power stations.

And at sea these same advantages have called for the installation of Aldrich-Groff "Powr-Savr" Pumps on more than 100 ships.

Write today for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP CO.

7 GORDON STREET
ALLENTOWN · PENNA.

Get Old Valves Back On Their Feet Again

—at less than half of the new valve cost

FOR VICTORY'S SAKE reclaim all your Iron, Steel or Brass valves. Every old valve put back in service means that another new one is available for vital war industry—to keep production lines flowing.

Send us those leaky old gate and globe valves you had planned to discard. Our experienced "Valve Doctors" will repair worn seats, discs and other parts. Our charges never exceed 50% of the original valve price; and they usually run around 35%. We pay shipping costs both ways on valves that can't be fixed.

For Victory, Salvage Old Valves — Send Them To
THE COMBUSTION EQUIPMENT & INSULATION CO.
Factory at Greenlawn and Erie R. R. Tracks, Lima, Ohio

C. F. Kettering Heads TINU Committee

FRANKLYN B. SNYDER, president of the Technological Institute of Northwestern University, has announced that eleven of the nation's leaders in business, industry, and technical education will serve on a new advisory committee on the development of this institute.

Charles F. Kettering, vice-president of General Motors Corp., will be chairman of the committee, which will counsel with the University on matters relating to the future educational and research programs of the Institute in the fields of science and engineering. Four years ago Mr. Kettering acted as an adviser for the Technological Institute, being selected in that capacity by the late Walter P. Murphy, railway supply manufacturer, who founded the Institute in 1939.

Members of the committee from business and industry include Henry J. Kaiser, shipbuilder and industrialist; Juan Trippe, president of Pan American Airways; James S. Knowlson, president of Stewart Warner Corporation and former assistant chairman of the War Production Board; Gen. Robert E. Wood, chairman of the board of Sears Roebuck and Company; Ralph Budd, president of the Burlington Railroad; and Paul E. Klopsteg, president of the Central Scientific Company.

In the field of technical education, the committee includes four presidents of engineering schools: Karl T. Compton, Massachusetts Institute of Technology; Robert A. Millikan, California Institute of Technology; William E. Wickenden, Case School of Applied Science; and Robert E. Doherty, Carnegie Institute of Technology.

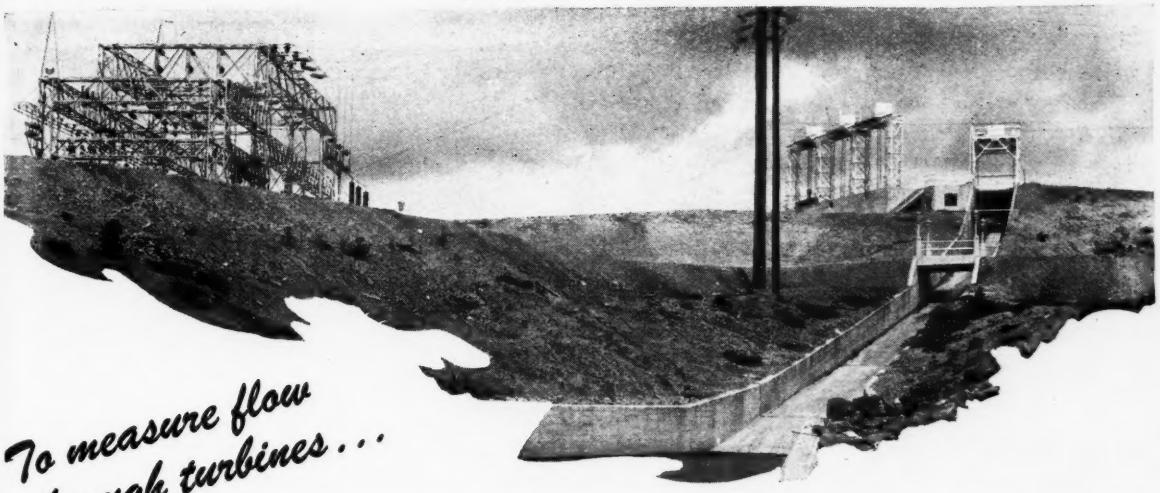
The new committee will concern itself primarily with the program and activities of the Institute in the postwar era. It will counsel the Institute on such important subjects as the future of engineering in America and abroad, the relations between the Institute and industry, the field of theoretical and applied research, the devising of curricula in engineering and science, and new techniques in engineering education.

The Institute conducts its educational program on the "cooperative plan," under which the student alternates three months of study on the campus with an equal period of work in industry.

At present, in addition to training engineering students, the Institute is engaged in many services essential to the war effort, including governmental research and the technical training of military personnel.

Engineers Advanced by PSE&G Co.

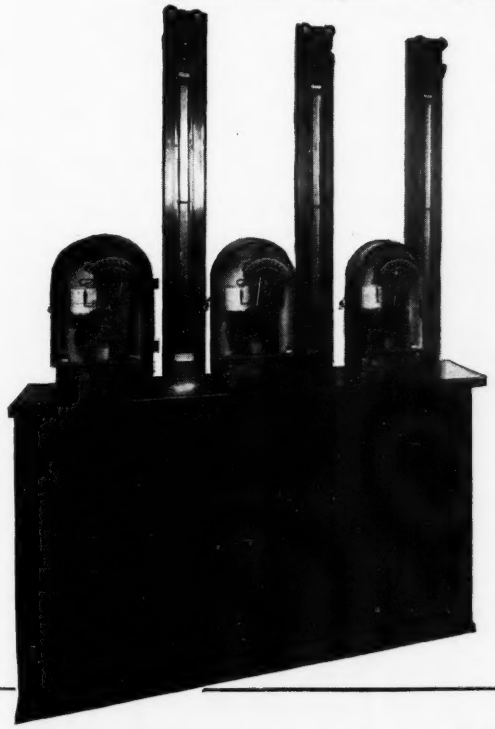
JACOB T. BARRON, vice president in charge of electric operation, Public Service Electric and Gas Co., Newark, N. J., has announced the following changes in the company's electric operating department: Edwin H. Snyder, from assistant to the chief engineer to assistant chief engineer, Electric Engineering Department, succeeding Walker L. Cisler, who resigned to take a position with the Detroit Edison Co. Philip H. Hartung, from superintendent, Kearny Generating Station, to assistant general superintendent of generation, General Office. Richard S.



To measure flow through turbines . . .

Hydro plants the world over use the SIMPLEX W-K PRINCIPLE

IN the United States, Canada, South America and in Russia, hydro turbines depend on the Simplex W-K principle for flow measurement. By using the turbine scroll casing as a primary device in conjunction with the Simplex Type MO Meter Register, the Simplex W-K principle makes it possible to indicate and continuously record and totalize the discharge rate of the water through each turbine unit.



W-K taps placed on the turbine casings at the time of erection, or installed without difficulty on existing operations, provide an accurate measurement of turbine flow.

The flow rate data thus derived aids materially in the determination of total plant operating efficiency. Flow rates are easily compared with kilowatt loading; total water horse power and water input may be compared with electric output; check tests are available at any time without alteration of conditions or equipment.

This is another Simplex "First" — and hundreds of hydro plants all over the world are benefiting by the use of the Simplex W-K principle on turbines of various capacities.

Write today for full information on the advantages of adding water flow rate facts to your working essentials.

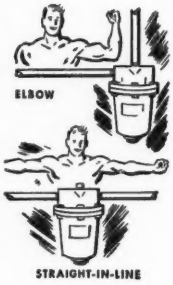
SIMPLEX VALVE & METER COMPANY

6783 UPLAND STREET, PHILADELPHIA 42, PA.

LET'S STRAIGHTEN OUT
these contortionists

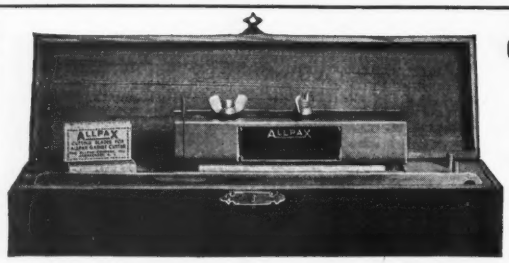
Years ago our steam trap piping frequently looked like the freak contortionist of circus and stage. Let's straighten out these contortionists in future steam trap piping by specifying and installing only ANDERSON SUPER-SILVERTOP STEAM TRAPS, the inverted bucket steam trap that can be piped straight-in-line or as an elbow . . . that doesn't require the purchase of extra fittings . . . that saves as much as an hour of installation time per trap. And with simplified piping, Anderson Super-Silvertop Steam Traps bring you greater condensate capacity, positive operation, ease of inspection and a longer service-life.

You can find out all about these advantages of Anderson Super-Silvertop Steam Traps by sending for a copy of the booklet, "How to Choose a Steam Trap," which is yours for the asking.



THE V. D. ANDERSON COMPANY
1939 WEST 96th STREET • CLEVELAND, OHIO

Super-Silvertop
STEAM TRAPS



Cuts your gasket costs in half

The most remarkable tool ever invented

Write for booklet

THE ALLPAX GASKET CUTTER
Manufactured by
THE ALLPAX COMPANY, INC.
Distributors everywhere ***Mamaroneck, N. Y.***

Hopkins, from chief engineer, Kearny Station, to superintendent, Kearny Station. LeRoy A. Brown, from chief engineer, Perth Amboy Generating Station, to chief engineer, Kearny Station. Earl C. McMahon, from engineer to chief engineer, Perth Amboy Station.

Mr. Snyder has been with Public Service since September, 1923, when he started as a cadet engineer, Electric Department, a few months after being graduated from Lehigh University. On June 1, 1926, he was assigned to the distribution engineer's office in Newark and later was placed in charge of a planning group in that office. On January 20, 1937, he was promoted to assistant to the chief engineer in the Electric Engineering Department.

Starting with the company in July, 1923, as a cadet engineer after being graduated from Lehigh University, Mr. Hartung was made assistant engineer at Kearny Generating Station, July 1, 1926; test engineer at Essex Station three years later; fuel engineer, electric generation department, in 1934; load schedule engineer in 1935; chief engineer at Kearny Station in 1936; and superintendent there a year later.

Mr. Hopkins, upon being graduated from Stevens Institute of Technology, started with Public Service in June, 1919, as a cadet engineer. In 1921 he was made technical assistant at Burlington Generating Station and four years later became foreman, boiler repairs, first at Essex Station and later at Kearny Station. In 1926 he was promoted to first assistant engineer at Kearny Station, later becoming boiler room engineer and then chief engineer at that station.

A graduate of Lehigh University, Mr. Brown was employed by the company as a cadet engineer in July, 1926, and was assigned to the test department at Essex Station in 1929. About seven years later, he was made test engineer at Kearny Station and in 1940 was promoted to chief engineer, Perth Amboy Station.

Earl C. McMahon, a Massachusetts Institute of Technology graduate, started with Public Service in 1926 as a cadet engineer and in 1929 was assigned to the test department at Kearny Station. The following year he was made engineer-loads, generation department and ten years later became assistant engineer in that department. In July, last year, he was promoted to engineer at Perth Amboy Station.

National Security Award

ANNOUNCEMENT has been made by the United States Office of Civilian Defense that it is establishing the National Security Award to recognize those industrial plants which have developed superior safeguards against fire, sabotage, accidents, or possible air attack. All industrial plants and related establishments, including those assigned to the continuing protection responsibility of the War and Navy Departments, are eligible for OCD's National Security Award. The relative size of the plant is not a factor in granting the Award, which will be made to individual plants and not to a company or corporation for all its establishments.

Nominations for the Award may originate from the industrial plant itself and be made to the local Defense Council. Such a nomination will be transmitted to the State Defense Council for approval and from there to the Regional Civilian Defense Office. For facilities assigned

Troy-Engberg Power is *Low Cost* Power Because it's *By-Product Power*

THE Troy-Engberg Steam Engine rates high in dependability, economy and utility. Where plant conditions are favorable, it is the most modern drive for stokers, pumps, compressors, blowers, fans, generators and other boiler room and process plant equipment.

WHEN heat balances are favorable, the Troy-Engberg Steam Engine captures the "by-product power" in the steam. We can point to many units where the savings made possible by this "by-product power" have been large enough to pay for the entire cost of the engine in only a year or two.

And there are other values along with economy. The Troy-Engberg Steam Engine offers a very wide speed range amenable to automatic control . . . high starting torque and ability to handle overloads over long periods . . . freedom from fire hazard . . . and, under certain conditions, oil-free exhaust. It provides steady operation over a period of many years without requiring major repairs.

TROY ENGINE & MACHINE CO.

Established 1870

1202 Railroad Avenue **Troy, Pennsylvania**

11-TEM-1

ROTO Model 135 air-driven motor with swing-frame head and air valve for one-man operation.

Wherever labor shortages exist, Roto Tube Cleaners, equipped for one-man operation, are indispensable. By giving the operator full control of air, you can not only release his helper for other work, but actually enable him to do a better, faster job. There is no time lost signalling a helper at a remote point to turn air on and off, saving many hours on the entire job. Whatever your tube cleaning requirements are, Roto can fill them satisfactorily.

The ROTO Company

145 Sussex Ave. Newark 1, N. J.

WHEN YOU WRITE TO ADVERTISERS

When writing advertisers for catalogs, descriptive bulletins or prices, please remember to say, "I saw your message in POWER PLANT ENGINEERING." Thus you'll do a good turn for the advertiser and for this publication. . . .

to a participating agency of the Facility Security Program, OCD, nominations may be made by the responsible department or agency to the Regional Office. Facilities assigned to the War and Navy Departments may be nominated through usual channels to the Regional Office by the responsible branch of the Army or Navy, or through the Regional Industrial Passive Defense Committee.

Exposition of Chemical Industries

THE 19TH EXPOSITION OF CHEMICAL INDUSTRIES, which comes to Madison Square Garden, New York, the first week in December, will be the first industrial review of its kind since the war began, it may be the last before peace is declared. Manufacturers, meanwhile, face the double demand for greater production efficiency now and greater economic efficiency hereafter. Expansion in chemical processing since the last war has been tremendous. New ingredients have been evolved by research, new processes invented to make them, new products developed through their use. The use of power and steam in all these processes is growing continuously.

Recent change reflected in the Exposition, involving hundreds of detailed applications, reveals most pointedly the effects of five major influences. These are the more extensive uses of extreme temperatures and pressures, the introduction of new catalytic agents, the advantage of mass production, and finally improved instruments for research and process control.

One of the significant features at Madison Square Garden will be an exhibit by the Alien Property Custodian of the United States Government of the complete library of former enemy-controlled patents, now available for use under license by American manufacturers in chemical, electrical and mechanical fields. This collection, consisting of some 45,000 patents and patent applications, will be brought from Chicago especially for the Exposition. Representatives of the Custodian will be on hand to confer with visitors over possible grants of further manufacturing licenses.

Some of the exhibits will be particularly applicable to the manufacture of delicate instruments, others to research laboratories. Still other exhibitors serve more directly power plants, public utilities and the communications industries.

The Exposition will be closed to the public, admission being by invitation and registration only to executives, chemists, chemical engineers, plant managers and staff personnel directly associated with industries having a chemical interest.

National Fuel Efficiency Council Appointed

A FUEL EFFICIENCY program to combat wasteful practices in the use of coal, coke, wood, petroleum and gas, has been announced by the U. S. Department of Interior. Emphasis will be placed first on commercial and industrial plants, with the program to be expanded later to include small consumers, home owners and others.

Dr. R. R. Sayers, Director of the Bureau of Mines, has named from private industry a National Fuel Efficiency Council of 12 engineers outstanding in the field of fuel utilization to chart and direct the campaign in cooperation with the Bureau of Mines.

The National Fuel Efficiency Council

HELPING RAILROADS MOVE HEAVIER WARTIME LOADS..

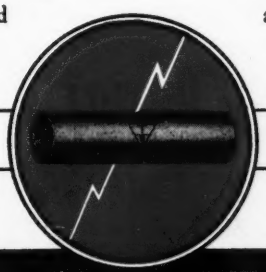
Talon's Electric Welded Steel Tubing . . . . .

SIZES FROM 5/8" O.D. TO 4" O.D. UP TO 40' IN LENGTH

This illustration shows Talon's Electric Welded Steel Tubing being used in boiler construction by the Lima Locomotive Works for the Central of Georgia Railway.

Talon's Electric Welded Steel Tubing has characteristics which are particularly well suited to locomotive boilers. It withstands the terrific high pressure and structural strain which locomotives are undergoing to haul heavier wartime loads more rapidly. Cold-formed from flat-rolled steel, Talon's tubing is concentric and uniformly accurate to size for easy installation. Proper normalizing provides maximum ductility for expanding and beading, and increases physical properties.

There are no thin, weak spots in the wall of Talon's Electric Welded Steel Tubing . . accurate gauge of the steel determines uniform wall thickness. No extra metal is added in welding . . . grain structure of wall and weld is homogeneous. Hydrostatic testing of every foot of Talon's Pressure Tubing is your assurance that the weld and adjacent area are as strong as the wall. Sizes from 5/8" to 4" O.D. are available in lengths up to 40 feet.



PRESSURE **MECHANICAL**

TALON . . INC.

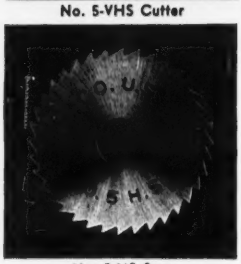
STEEL TUBE DIVISION OIL CITY, PENNA.

For Rapid Mica Undercutting use an IMPERIAL UNDERCUTTER

Simple to adjust—
Cuts very rapidly—
Runs without vibration.

Cuts either V-Shaped or U-Shaped Slot.

No. 5-VHS Cutter



No. 5-HS Saw

Check these Imperial features:

Micrometer screw to adjust V-shaped slot guide . . . V-shaped roller guide to ride in an adjacent slot to guide the cutter . . . V-shaped milling cutter. Slotting saws may be used for U-shaped slot . . . Depth gauge to regulate depth of slot, with Micrometer Screw adjustment . . . Flexible shaft motor drive . . . Detachable handles . . . Air hose connection to blow any dust . . . Furnished with or without motor.

Send for Catalog No. 24 describing this and many other Maintenance and Electrical Items.

THE MARTINDALE ELECTRIC CO.
1432 HIRD AVE. CLEVELAND 7, OHIO

OFFICIAL WAR MESSAGE NO. 11

Want to Keep Prices Down?

Of course you do! So do all of us. You can be a *big* help if you'll just remember this:

You *can't* keep prices down by passing the buck. *Everyone* has to make necessary wartime sacrifices. It's up to each *one* of us . . . not "the other fellow".

Because of the war, there's *less* of almost everything to go around . . . but *more* money to buy those things. So if we *all* try to buy them, prices are bound to go up.

Buy only what you really *need* and put the money you save to work helping win the war.

You *can* keep prices down if you: use it all, wear it out, make it do, or go without. Pay your debts. Pay your taxes. Buy more bonds and *Smash the Axis!*

working with Bureau of Mines officials will recommend procedures best suited to carry its fuel-economy suggestions to the consumer. In a recent preliminary meeting, at which the engineers pledged their services and outlined tentative plans, the council estimated conservatively that industrial, commercial, and domestic uses annually could save 29 million tons of coal alone by adopting known methods of efficient utilization. At present it is estimated that coal production in 1943 will not meet requirements, and increasing military needs are likely to cause a more serious shortage in 1944 unless production is increased and waste is eliminated.

Members of the council are Chairman Thos. C. Cheasley, new supervising engineer of the Bureau's National Fuel Efficiency Section who for the last 13 years has been fuel engineer for the Sinclair Coal Co. of Kansas City, Mo.; O. F. Campbell of East Chicago, Ind., combustion engineer for the Sinclair Refining Co.; W. G. Christy of Jersey City, N. J., smoke abatement engineer for the Hudson County Department of Smoke Regulation; C. F. Hardy of Cincinnati, Ohio, manager, Fuel Engineering Division, Appalachian Coals, Inc.; H. K. Kugel of Washington, D. C., smoke regulation engineer for the District of Columbia; L. S. Reagan of Tulsa, Okla., vice president, Webster Engineering Co.; C. A. Reed of Washington, D. C., director, Engineering Department of the National Coal Association; H. J. Rose of Primos, Pa., vice president in charge of research, Anthracite Industries, Inc.; R. A. Sherman of Columbus, Ohio, supervisor, Fuels Division of Battelle Memorial Institute; A. W. Thorson of Washington, D. C., head conversion engineer, Solid Fuels Administration for War; I. E. Tobey of New York City, managing director, Coal Bureau, Upper Monongahela Valley Association; and an ex-officio member, J. F. Barkley of Washington, D. C., chief, Division of Solid Fuels Utilization for War, Bureau of Mines.

Tentative plans call for the organization of subcommittees of engineers to carry out the program at regional and local levels. Hundreds of engineers already have expressed their willingness to cooperate. The assistance of national engineering societies and other organizations also is being sought. The council will depend primarily upon education and training of industrial and domestic consumers to achieve results.

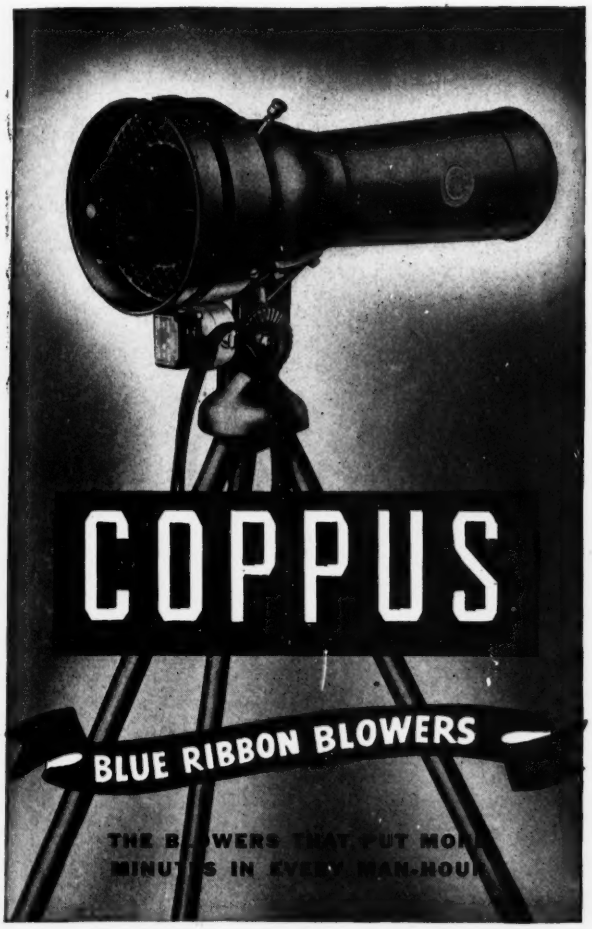
The initial appeal will be made, largely by personal approach of local engineers, to commercial and industrial users. Group meetings among national trade and professional organizations also are expected to help. Later the program will be expanded to include small consumers, home owners and others, with fuel-efficiency talks before established organizations supplemented by specialized literature and publicity through various media.

Contract for Sale of Power from Shasta Dam

CONTRACT for the sale of the first block of power from Shasta Dam of the Bureau of Reclamation's Central Valley Project (California) to the Pacific Gas & Electric Co., with headquarters at San Francisco, has been negotiated and executed through the U. S. Department of Interior. A minimum annual payment by the company of $2,775,000 beginning in 1945 is guaranteed. Under the agreement, which was signed September 16, the United States will

New Strength through Air

WORKERS HAVE MORE WAR PRODUCTION "DRIVE" WITH A COPPUS BLOWER OR HEAT KILLER NEARBY



Thousands of cases prove that a man can do more work where it's cool and comfortable than where heat and bad air are continually sapping his energy.

In these cases, Coppus "Blue Ribbon" Blowers and Exhausters have earned their salt, bringing renewed energy, skill and morale to men working near furnaces . . . in tanks . . . in underground cable manholes . . . around hot processes.

Portable, adaptable for special purposes, each one built with Coppus "Blue Ribbon" precision and strength, they are putting more working minutes into every war-essential man-hour—more and better production every day!

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 340 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

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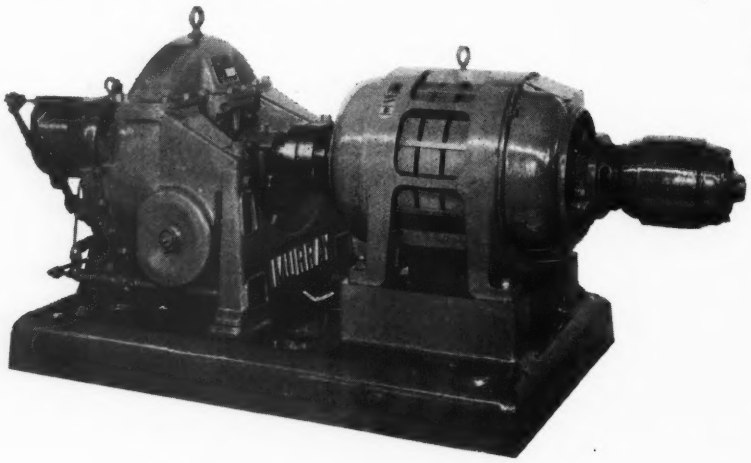
(Write here any special ventilating problem you may have.)

MURRAY

• TYPE "U" •

Mechanical Drive Turbines



MURRAY Type "U" Mechanical Drive Turbines are adaptable to a variety of drives. View shows Type "U" turbine directly connected to a 20 K.W. alternating current generator operating at 1800 R.P.M. The unit is installed in a large oil refinery in Venezuela where the turbine supplies exhaust steam for process requirements. . . . For details of construction and performance of Murray Type "U" Turbines, write for Bulletin T-118.

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

In Cooperation With

THE POST OFFICE

. . . we will appreciate it if you will add our new zone number (4) to all mail addressed to us, as shown below:

POWER PLANT ENGINEERING
53 W. Jackson Blvd. Chicago 4, Illinois

As you know, the new Post Office zone delivery system has been adopted to expedite the delivery of mail. Simple in operation, its success depends on the cooperation of all mailers.

transmit power to the company over a 97-mile transmission line which the Bureau of Reclamation is building from Shasta Dam to Oroville, Calif. It will deliver the energy to the P. G. & E. at the Shasta sub-station (25 miles from the dam) and will lease temporarily to the company, for a monthly rental charge of $6,250, the portion of the line extending from this sub-station to Oroville. The Shasta Dam power plant is scheduled to begin operating in March, 1944, with an installation of 150,000 kilowatts.

John I. Yellott Heads Institute of Gas Technology

JOHN I. YELLOTT, who has been chairman of the department of mechanical engineering and director of war training at Illinois Institute of Technology, Chicago, Ill., has been appointed full-time director of the Institute of Gas Technology at Illinois Tech, assuming his new post as of Sept. 1.

He succeeds Harold Vagtborg as director of the Gas Institute. Mr. Vagtborg will henceforth devote all his time to his duties as director of the Armour Research Foundation.

In becoming full-time director of the Gas Institute, Professor Yellott will also direct the educational program, formerly in charge of Dr. Lincoln R. Thiesmeyer, who resigned effective Sept. 1 to enter government service.

Professor Yellott has been chairman of Illinois Tech's mechanical engineering department for the past three years and became director of the war training program in its first year in 1941. For the latter service he was cited by the Chicago and Illinois junior chamber of commerce groups as the outstanding young man of 1942. More than 36,000 persons have been trained in this war training program, the largest in the nation in a single city and at a privately-operated college. Professor Yellott also helped organize an explosives safety school for the office of the chief of ordnance, United States War Department.

An honor graduate in mechanical engineering of Johns Hopkins University, Professor Yellott was formerly chairman of mechanical engineering at Stevens Institute of Technology and a member of the mechanical engineering faculty at the University of Rochester. He has also served as an industrial consultant in power and steam flow. In 1939, he was named as the outstanding mechanical engineer of the past decade by Pi Tau Sigma, honorary mechanical engineering fraternity.

Silent exhaust *means* more efficient man-hours . . .

It is well recognized today that excessive noise can be an important factor in reducing the efficiency of plant personnel. Maxim Silencers can reduce engine exhaust roar to a whisper, thus eliminating one of the most penetrating and nerve jangling rackets present in plant operation.

To the organizations unable to secure high enough priority ratings to get Maxim Silencers today, The Maxim Engineering department offers a consultation service that can often result in quieter operation of your present equipment. Simply give full details and write to The Maxim Silencer Co., 92 Homestead Ave., Hartford, Conn.

MAXIM WASTE HEAT UNITS SAVE FUEL

Descriptive Bulletins WH-100, WH-102, WH-103, on request

MAXIM

WARTIME ENGINEERING SERVICE

DIRTY FUEL destroys diesel engine efficiency

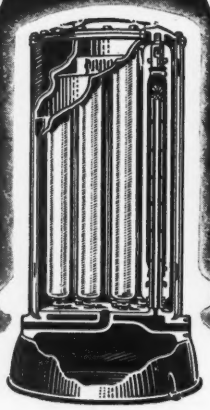


Photo-micro shows 45 times enlargement of the abrasives in one cc. of refined fuel oil. Sample taken after fuel had passed engine filter ready for injection. Chemical analysis showed—Moisture 3.5%, sediment .035%, Tarry matter .0475%.

Photo-micro shows 45 times enlargement of contamination in one cc. of the same refined fuel after passing one time, full flow, through Honan-Crane Fuel Oil Purifier. Chemical analysis showed—Moisture .005%, sediment .0035%, Tarry matter .003%.

THE DESTRUCTIVE ACTION OF CONTAMINATION IN DIESEL FUEL OILS WILL:

1. Produce excessive wear, gumming and scoring of pumps.
2. Cause abrasives to pit and wear injector equipment.
3. Clog oil passages, cause blowby and ring sticking.
4. Work down into lubricating oil.
5. Roughen valves and clog ports.

Honan-Crane Fuel Oil Purifiers can be DIRECT CONNECTED or used in bulk station installations for the removal of contamination from either refined or crude Diesel Fuel Oils.

This constant supply of clean fuel oil from the Purifier provides complete combustion, resulting in engine efficiency and economy of operation.

For complete information write for Bulletin No. 65.

HONAN-CRANE CORPORATION

Research Laboratories and General Offices
301 INDIANAPOLIS AVE. . . . LEBANON, IND.

OFFICIAL WAR MESSAGE NO. 6

NEXT OF KIN . . .

talked too much!

Telling a friend the number of John's regiment . . . or where he is now . . . or his kind of training . . . or about his inoculations . . . or any little thing about his army life, may seem harmless to you.

But Axis espionage relies on millions of sociable Americans telling friends these little things. Hundreds of such random phrases . . . pieced together reveal big military secrets!

Don't repeat even little things about our war effort unless they've been published or broadcast. Think *before* you talk!

Electric Energy Topped Record in August

PRODUCTION of electric energy for public use in August, 1943, totaled 18,945,194,000 kwhr, an increase of 18.3 per cent over production in August, 1942, and the highest monthly production on record, according to a report issued by the Federal Power Commission.

Average daily production of electric energy for public use in August was 657,819,000 kwhr, also a new high level and an increase of 3.6 per cent over average daily production during the previous month. Production by water power in August amounted to 5,864,003,000 kw hr, or 31.0 per cent of the total output for public use.

For the 12 months ended August 31, 1943, total production for public use was 206,442,294,000 kwhr, an increase of 15.6 per cent over the 178,524,030,000 kwhr produced in the 12 months ended August 31, 1942.

Generating plants in service in the United States on August 31, 1943, have a capacity totalling 48,400,962 kw, a net increase of 187,700 kw over generating capacity reported in service on July 31, 1943. However, occasionally changes are made in plants which are not reported promptly, so that capacity figures shown for any one month do not necessarily mean that all the changes were made during that month but that they have been reported to the Commission since the issuance of the previous monthly report.

Proposed Hydroelectric Power Plant in Alaska

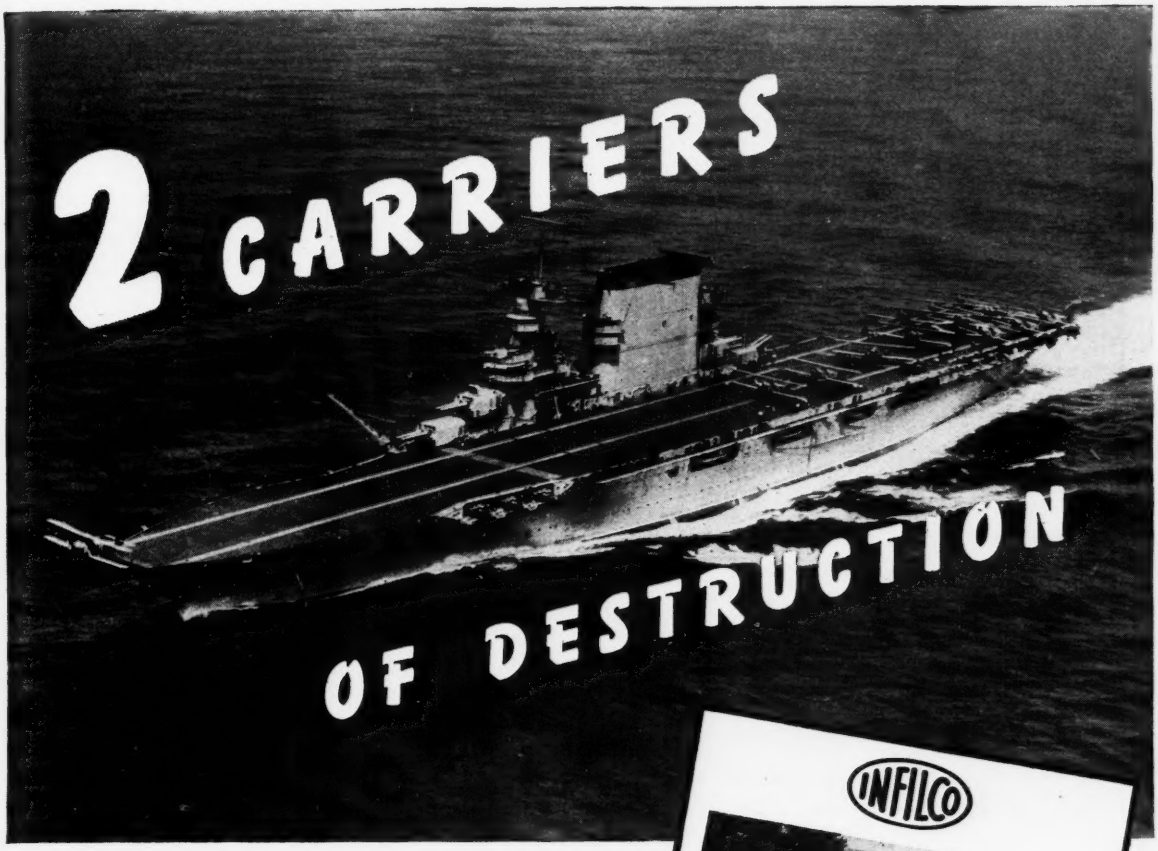
KETCHIKAN PUBLIC UTILITIES, Ketchikan, operating municipal power plant and system, has tentative plans under way for new hydroelectric generating station on Silvus Lake, at point known as Beaver Falls, to supplement present municipal plant of same type. It is estimated to cost approximately $475,000, of which it is proposed to arrange Federal financing in amount of $350,000, remainder to be furnished by municipality. City Council has authorized application to FWA for fund noted. It is understood that plans will be prepared by Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., consulting engineer, which has been making surveys and estimates of cost for project.

ASME 1943 Annual Meeting Nov. 29 to Dec. 3

PLANS FOR the 1943 Annual Meeting of the ASME to be held in New York City, November 29 to December 3, 1943 are being rapidly developed. The Pennsylvania Hotel has been selected as headquarters and a large number of technical sessions are being scheduled.

These sessions will include discussion of applied mechanics, fuels, heat transfer, hydraulics, industrial instruments, postwar planning, oil and gas power, steam and electric power, boiler feedwater, critical pressure steam boilers and other fields of mechanical and production engineering.

Plans have been started to provide space for an exhibit of about 35,000 mechanical and electrical patents of enemy countries that have been seized by the Alien Property Custodian.



Spectacular and instantaneous destruction results from the explosion of a Navy Bomber's torpedoes.

Destruction that is silent . . . perhaps slow . . . but nevertheless sure . . . can be carried by water into vital spots of your power plant.

Water . . . unless conditioned against scale, corrosion, embrittlement, oil, etc. . . . can destroy power plant equipment, efficient operation and fuel as effectively as a bursting torpedo.

Power plants, vital to the War Effort, are offered the protection of Infilco equipment for boiler and evaporator feedwater treatment, condensate oil removal, steam purification, cooling water conditioning, etc. The engineering staff and manufacturing facilities of this 48-year old organization are at your service.

INFILCO
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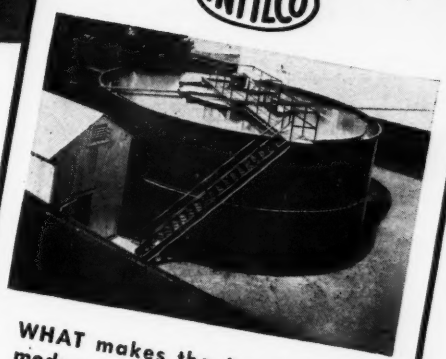
325 W. 25TH PLACE, CHICAGO, ILL.
Formerly INTERNATIONAL FILTER CO.

INFILCO



WHAT makes the Accelator the modern streamlined water treating process?

HOW does the Accelator process accomplish such remarkable results in such small space?

WHY has the Accelator so many exclusive advantages in clarifying, softening or stabilizing waters of widely varying qualities?

For the answers . . . send for Bulletin 1824

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ACCELATOR SOFTENERS • CATEXERS • CLARIFIERS
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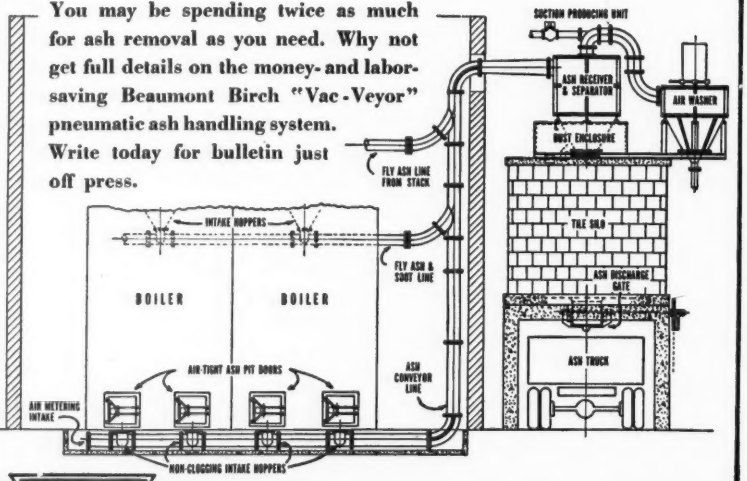
HOW MUCH ARE YOU PAYING TO HANDLE ASHES?

You may be spending twice as much for ash removal as you need. Why not get full details on the money- and labor-saving Beaumont Birch "Vac-Veyor" pneumatic ash handling system. Write today for bulletin just off press.



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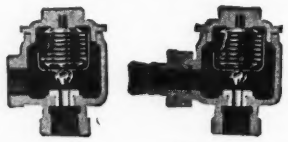
1505 RACE STREET PHILADELPHIA, PA.

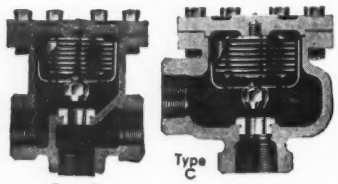
DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

PREVENT freeze-ups!

Install Non-Freezing NICHOLSON Industrial Thermostatic TRAPS



Type A Type AU



Type B Type C

FIVE TYPES
SIZES 1/4" TO 2"
PRESSURES TO 225 LBS.

HERE IS A TRAP that completely drains itself! It is non-freezing . . . non-air-binding . . . non-dribbling . . . requires no adjustment and prevents water logging. NICHOLSON Industrial Thermostatic Traps provide a discharge capacity two to six times greater than average traps—assuring maximum drainage efficiency and increased production through better circulation of steam in water heaters, pipe coils, kettles, dryers, cookers, etc.

Bulletin No. 843, W. H. NICHOLSON & CO., 160 Oregon St., Wilkes-Barre, Pa.

NICHOLSON Traps
THERMOSTATIC • PISTON AND WEIGHT-OPERATED STEAM, GASOLINE AND COMPRESSED AIR TRAPS

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

The Annual Business meeting of members of the ASME will be held Monday afternoon, November 29, at 4:00 p. m.

Although the technical sessions do not begin until Monday, November 29, the meeting will really begin on Sunday, November 28, with a meeting of the executive committee of the Council and a conference of local section delegates and there will be other meetings of various committees in the afternoon and evening of that day. The detailed program of technical sessions and data on other features will be announced to members about November 1.

Richmond, Va., Plans Utility Project to Cost $6,700,000

THE CITY PLANNING COMMISSION, Richmond, Va., is arranging a large expansion program for municipal utilities over a 10-yr period, beginning as soon as the war ends. Work will be carried out by the Department of Public Utilities and as now projected will include the following: New gas generating plants and extensions in present production facilities, estimated to cost $2,146,000; pipe lines for gas distribution in different parts of city, including improvements in present system, additional service connections, etc., to cost $822,000; extensions in electrical distribution system, with power substations and other operating facilities, $600,000; extensions and improvements in electric street-lighting system, $140,000; new water purification plant, with pumping station and other structures, to cost about $1,312,000; and extensions and improvements in municipal water system including pumping stations, with motor-driven pumping machinery and auxiliary equipment, pipe lines and other facilities, to cost approximately $1,682,500. Initial work will be covered by a $3,000,000 bond issue in 1944, a portion of such fund to be given over to utility program noted, and a similar bond issue in 1945.

Narragansett Electric Plans Postwar Generating Station

NARRAGANSETT ELECTRIC CO., Providence, R. I., has preliminary plans under way for a postwar steam-electric generating station, to be located in vicinity of Westerly, R. I., at place known as Thompson Corner, and covers a development initially projected a number of months ago and since in abeyance on account of the war. It is estimated to cost about $2,500,000, with turbine-generators and accessories, high-pressure boilers, etc. Project will include extensions in transmission lines for connection with present high-tension system, switch yard and other facilities. United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa., is consulting engineer and will be in charge of erection.

Army Utility Installation Covers Large Operations

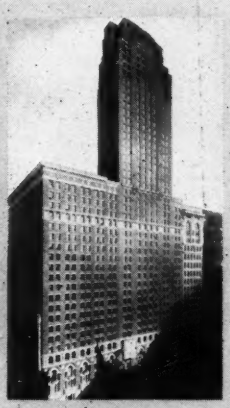
WAR DEPARTMENT, Washington, D.C., has recently arranged a summary of army construction since the war began, covering different phases of installation and gross expenditures for land, buildings, utilities, etc. In connection with latter, it is stated that 16,680 miles of electrical distribution lines have been installed; the purchase of electric energy

These Companies Don't Buy Electric Power They Generate Their Own, with . . .

SKINNER "Universal Unaflow" STEAM ENGINES

Large pump manufacturer in Ohio. Two 3-cylinder vertical "UNIVERSAL UNAFLOW" Steam Engines with 3-wire D-C generators, 1000-kw. total capacity. Steam pressure 250 psi., 100° F. s.h., back pressure 0-2 psi. Installed 1930, '37.

Prominent meat packing plant in Cincinnati, Ohio. Three horizontal "UNIVERSAL UNAFLOW" Steam Engines with 3-ph., 60-cy., 240-v. A-C generators. Total capacity 882-kv.a. Also 400-i.hp. engine driving vertical ammonia compressor. Steam pressure 165 psi., 70° F. s.h., 0-2 psi. back pressure. Installed 1923, '27, '35, '36.



Well-known hotel in Chicago, Ill. Two horizontal "UNIVERSAL UNAFLOW" Steam Engines with 3-wire D-C generators, 1500-kw. total capacity. Steam pressure 125-150 psi., sat., 0-2 psi. back pressure. Installed 1925, '30.

Large department store in Salt Lake City, Utah. Three horizontal "UNIVERSAL UNAFLOW" Steam Engines with 3-ph., 60-cy., 240-v., 4-wire A-C generators, total capacity 1314-kv.a. Steam pressure 150 psi., 100° F. s.h., 5-7 psi. back pressure. Installed 1939, '41.

Famous military academy in Indiana. Two horizontal "UNIVERSAL UNAFLOW" Steam Engines with 3-ph., 60-cy., 2300-v. A-C generators, 812-kv.a. total capacity. Steam pressure 150 psi., 50-75° F. s.h., 5 psi. back pressure. Installed 1927, '39.

A few of the many purchasers who have given us one or more Repeat Orders.

A Repeat Order Is The Best Evidence of Satisfaction.

ARMY (E) NAVY

Proudly we fly the Army–Navy "E" Flag, awarded for excellence in production

LIKE hundreds of other manufacturers and operators of various types of institutions, the power users shown here have found it more economical to generate their own power with Skinner "Universal Unaflow" Steam Engines than to purchase it from the local utility.

In practically every known industry savings are being effected where far-sighted management is using Skinner engine-generating equipment. Although you may have a seemingly low *rate per kilowatt-hour* for purchased power, it will pay you to investigate, for postwar planning, how much lower your *cost* could be for power generated by Skinner "Universal Unaflow" Steam Engines.

At present we are engaged entirely in building engines for the War Program, but our engineers are always available to discuss planning for the future. Case studies pertaining to your particular industry will be sent upon request.

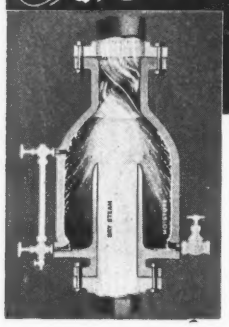
INVEST TODAY IN BONDS FOR VICTORY

Our Seventy-fifth Anniversary

1868 - 1943

SKINNER ENGINE COMPANY FOUNDED IN 1868 **ERIE, PA.**

Whirl the costly hazards out of your steam with Swartwout Separators



● You'll appreciate the *simple, sure* separating action of the *helico-centrifugal principle* used in Swartwout Separators. No slugs of water can slip by to ruin engine or turbine: no dirty oil or grease to spoil work in process. "It's the *whirl* that does the trick." Positive separating action without pressure loss. Adequate storage capacity. Occupy small space. Illustration shows vertical type. Swartwout Separators also are made in horizontal type, and for all pressures and all temperatures. . . . Write for Bulletin S-14-B.

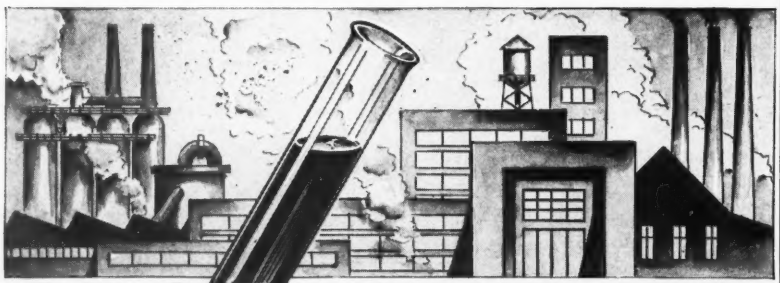
THE SWARTWOUT COMPANY
18511 EUCLID AVENUE • CLEVELAND, OHIO

Over 5000 of the Swartwout Separator style shown below are in use.

SWARTWOUT EXHAUST HEAD

Operates on same principle as Separators. Removes oil and water without changing direct flow of steam. Causes no back pressure. Sizes 1 in. to 30 in. Write for Bulletin S-16-A.

Swartwout



PROTECTED BY HAERING GLUCOSATES

Protect your plant against corrosion, the destroyer of piping systems, boilers and condensers. Corrosion scale retards heat transfer and lowers efficiency. Call in a Haering engineer without obligation, and let him show you how Haering Glucosates save you money and increase production. Or write for these booklets . . .

"Organic Methods of Scale and Corrosion Control"

"Water Studies"

"Water Treating"

WE READ WATER

D. W. HAERING & CO., Inc.
GENERAL OFFICES
205 West Wacker Drive Chicago, Illinois.

now exceeds 3,400,000,000 kwhr, annually; gas requirements will soon be on a basis of 65,000,000,000 cu ft per annum; ice-manufacturing plants provide a gross of about 50,000 tons per day; and daily requirements for water average 500,000,000 gal. Army facilities in the continental United States during 1944 will consume over 10,000,000 tons of coal, while 3,000,000 bbl of fuel oil for heating service will be required in the same period.

Bureau of Reclamation to Build Pumping Stations at Modoc, Calif.

BUREAU OF RECLAMATION, Denver, Colo., has plans under way for three new pumping stations on the Modoc unit of Tule Lake Division, Klamath project, Calif., and project is expected to mature in near future. Appropriations have been authorized. All plants will be of low-lift type; one will operate under a head of 20 ft, with installation to consist of three vertical centrifugal pumping units, each with capacity of 33⅓ cfs. The pumps will be driven by 100-hp vertical induction motors, to be housed in a timber frame structure supported on concrete foundations. Installation will include controls and auxiliary equipment. Another station will operate under a head of 12 ft, with similar type and capacity pumping units, driven by three 60-hp vertical induction motors. The third plant will have a head of 10½ ft, with installation comprising three motors of type mentioned, each with rating of 25 cfs, complete with controls, etc. As in first noted instance, the pumping stations of last two installations, will comprise timber frame structures. It is understood that call will be issued for competitive bids for equipment in near future. In addition to pumping stations, installation at Modoc will include about 11 miles of protective dikes, a lateral system for approximately 12,500 acres of land, and a drainage installation.

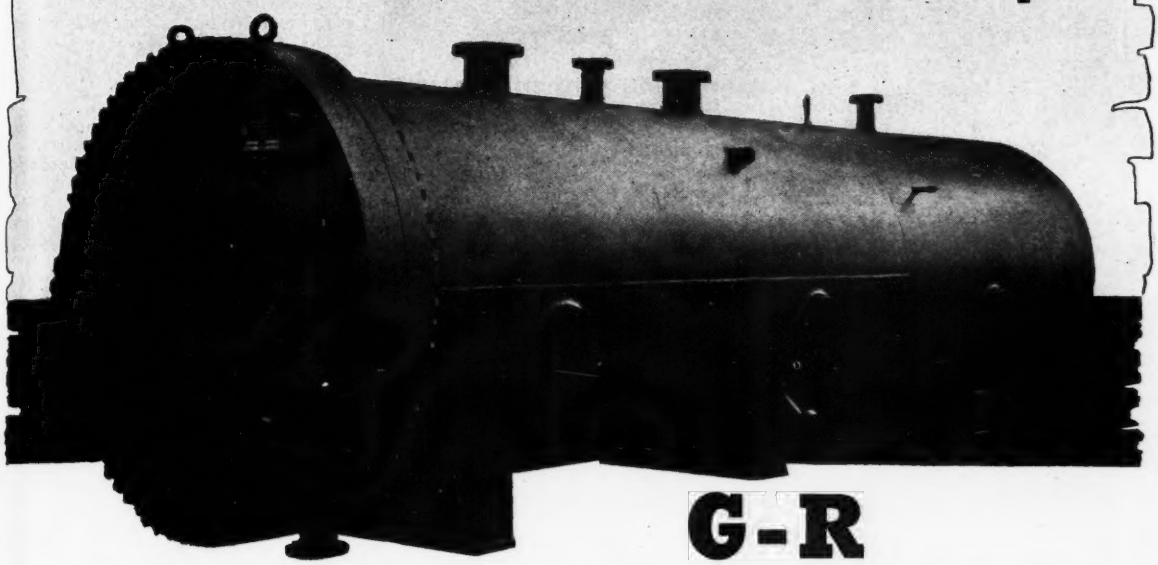
Detroit Edison Co. Promotes Company Officials

THE DETROIT EDISON CO. recently made the announcement that Paul W. Thompson, Angus D. McLay and Samuel M. Dean have been promoted in the ranks of the Company officials. Mr. Thompson is now a vice president with general responsibility for engineering and in charge of power generation, central heating and the construction bureau. Mr. McLay is vice president in charge of the Sales Department. Mr. Dean was appointed Chief Engineer of the system, in charge of the planning and engineering.

New Director of Research ASHVE

CYRIL TASKER has entered upon his duties as Director of Research of the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York City. For the past 13 years Mr. Tasker has been a member of the staff of the Ontario Research Foundation and as senior research fellow has carried on many important investigations relating to fuels, and a variety of problems connected with heating and air conditioning. The selection of Mr. Tasker for the important assignment of carrying on the Society's Research program was made

For SUSTAINED CAPACITY...PURITY of Boiler Feed Make-Up



G-R BENTUBE EVAPORATORS

EXAMPLES OF G-R PIONEERING

Coil-type Water Heaters
Stationary Make-up Evaporators
Scale-shedding Evaporators
Finned-tube Exchangers
Exchangers for Dirty Fluids
Scale-shedding Coolers and Condensers

ARMY E NAVY

SUSTAINED CAPACITY . . . without laborious hand cleaning . . . is maintained in G-R Bentube Evaporators by their thermal scale shedding feature.

SUSTAINED PURITY is assured by experienced design for proper balancing of disengaging area . . . headroom . . . vapor velocity . . . and other vital factors.

G-R BENTUBE EVAPORATORS have many additional advantages . . . rugged construction . . . readily accessible joints . . . efficient vapor separators . . . easy withdrawal of tube bundle.

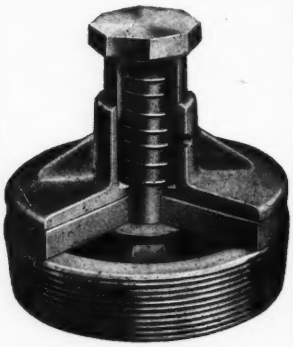
These typical design features make G-R Evaporators of all types widely preferred . . . as evidenced by more than 3000 stationary and marine installations.

THE GRISCOM-RUSSELL CO. 285 MADISON AVE. NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

Can you afford to run racing STEAM-WASTING PUMPS?



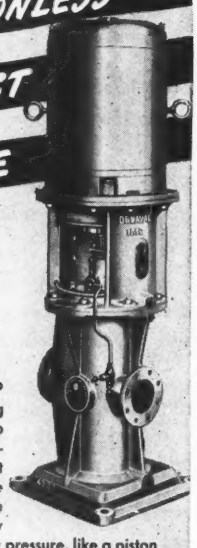
S-l-o-w 'Em Down With COMBINATION NON-TILT VALVES

If your plant operates two or more reciprocating pumps—Boiler Feed, Vacuum, Condenser, General Service—the chances are that you can save up to 15% in steam and cut maintenance cost at the same time by using COMBINATION Pump Valves. They lift straight, close quickly, prevent racing and hammering, eliminate many pump repair bills. Ask for descriptive bulletin.

They Match the Fine Performance of Combination Silent Check Valves.

COMBINATION PUMP VALVE CO.
846 WIOTA STREET, PHILADELPHIA 4, PA.

VIBRATIONLESS
COMPACT
SIMPLE

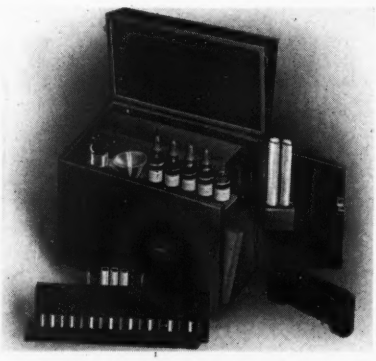


IMO
I MOVE OIL

The **DE LAVAL ROTARY OIL PUMP** has only 3 moving parts, no gears, no valves and no separate bearings. It propels any grade of oil in any volume in a smooth, steady stream against any pressure, like a piston moving always in one direction. The IMO motor-driven pump here shown is one of five in lube oil service on each of the largest and fastest Great Lakes ore carriers.

Ask for Publication I-106

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey



BOILER TROUBLE CAN BE *"NIPPED IN THE BUD"*

Keep close check on pH and phosphates in your boiler water, and you'll eliminate those costly descaling jobs.

For the easiest, absolutely accurate way, use a Taylor Boiler Water Comparator. Determinations are simple, quick and sure. Iron salts, silicates and sulfites do not interfere.

Taylor Comparators are made of durable molded plastic . . . and all Taylor color standards carry an *unlimited* guarantee against fading.

See your dealer or write direct for free booklet.

W. A. TAYLOR AND CO.
7301 YORK RD. • BALTIMORE-4, MD.

by the Committee on Research and unanimously approved by the Council of the Society.

Mr. Tasker was born in Manchester, England, and graduated from the University of Manchester in 1923 with the degree of M.Sc. (Tech.). Until 1930, when he came to Canada, he was on the staff of the British Fuel Research Board. He became a member of the Society in 1935 and has served as a member of the Committee on Research, and of the following Technical Advisory Committees from 1936 to date: Fuels, Insulation, Physiological Reactions, Air Conditioning in Industry, and Sensations of Comfort. He was elected to Council in 1941 and resigned on taking up this appointment.

Fuel Consultants Appointed

SIXTY-TWO engineers have been appointed by Solid Fuels Administrator Harold L. Ickes to serve the *Solid Fuels Administration* without compensation for general consultation and field survey work solely in connection with engineering problems involving utilization of coal. The engineers who have accepted appointment to assist the Administration remain free to continue their regular occupation. Their services will be available to industrial consumers who desire advice on combustion problems in their plants.

J. E. Tobey, 122 E. 42nd Street, has been designated as chief consultant in the New York area and Vernon G. Leach, 231 S. La Salle Street, as chief consultant in the Chicago area. The list of consultants follows:

Joseph W. Lloyd, DeBardeleben Coal Corp., Transportation Bldg., Birmingham, Ala.; Larry W. Milner, Brookside-Pratt Mining Co., Comer Bldg., Birmingham, Ala.; Chester A. Reed, National Coal Association, Southern Bldg., Washington, D. C.; Paul R. Hayes, Blue Diamond Coal Sales Co., Augusta, Ga.; Fred H. Bird, Binkley Coal Co., 230 N. Michigan Ave., Chicago, Ill.; Peter G. Hacquebart, Raleigh Smokeless Fuel Co., 624 S. Michigan Ave., Chicago, Ill.; Joseph Harrington, Northern Illinois Coal Corp., 310 S. Michigan Ave., Chicago, Ill.; Howard A. Herder, Sahara Coal Co., 59 E. Van Buren St., Chicago, Ill.; Vernon G. Leach, Peabody Coal Co., 231 S. La Salle St., Chicago, Ill.; Lowell Malan, United Electric Coal Companies, Mine No. 11, DuQuoin, Ill.; Roswell C. Rasmussen, Bell & Zoller Coal Co., 307 N. Michigan Ave., Chicago, Ill.; Lynn S. Spring, Koppers Coal Div., 224 S. Michigan Ave., Chicago, Ill.; Robert L. Sutherland, Truax-Traer Coal Co., 8 S. Michigan Ave., Chicago, Ill.; Albert E. Vatter, Walter Bledsoe & Co., 310 S. Michigan Ave., Chicago, Ill.; Shepard H. Viall, Chicago, Wilmington & Franklin Coal Co., 322 S. Michigan Ave., Chicago, Ill.; Stephen J. Bond, Enos Coal Mining Co., 1405 Merchants Bank Bldg., Indianapolis, Ind.; Max A. Tuttle, Knox Consolidated Coal Co., Consolidated Bldg., Indianapolis, Ind.; William A. Williams, Island Creek Coal Sales Co., 1410 Sturm Ave., Indianapolis, Ind.; Don W. Machin, Pittsburgh & Midway Coal Mining Co., 2212 Vermont St., Lawrence, Kan.; Eugene D. Benton, Louisville & Nashville R. R. Co., 9th and Broad Sts., Louisville, Ky.; Vaughn Mansfield, Southern Coal Co., Stark Bldg., Louisville, Ky.; Thomas J. Tarzy, Southern Coal Co., Inc., Stark Bldg., Louisville, Ky.; John R. Etlar, Fidelity Engineering Co., Fidelity Bldg., Baltimore, Md.; Wilbur D. Lawson, Consolidation Coal Co., Baltimore Life Bldg., Baltimore, Md.; Felix E. Rapetto, Poca-

Fighting a Fire Sometimes was Safer Than GOING TO IT

Firemen, of course, must work fast. In the old days, you were apt to be trampled to death when the alarm sounded. When the idea came along for a brass pole to let the fireman slide slick-as-a-whistle to the first floor, America took it up in a hurry.

Americans in every walk of life always have preferred simple operations to complicated ways of doing things. Hence the high favor in which Busch-Sulzer Diesels are held. Just a glimpse at these engines suggests their simplicity of design—and a careful check of details proves it. This is an important factor in the operating and maintenance economy of a Busch-Sulzer. It was first, you know, with the trunk piston principle in the larger Diesels—an innovation more than a dozen years ago, an established success today.

Although working 'round the clock on naval ordnance and engines for the Navy, Army and Maritime Commission, we can fill high priority orders for either stationary or marine Diesels in horsepowers from 500 to 3000. We welcome your inquiry.

BUSCH-SULZER DIESEL ENGINE COMPANY
SAINT LOUIS

BUSCH-SULZER
ST. LOUIS

AMERICA'S OLDEST BUILDER OF DIESEL ENGINES

An up-to-the-minute Gasket Chart showing the cross-sections of 36 most popular Gasket Types, their purposes and the characteristics which fit them for the specific services intended, is now available to interested engineers.

This chart has been issued as the third in a series of technical papers on Gaskets compiled by the Research Laboratory of the Goetze Gasket and Packing Company, Inc., oldest and largest manufacturers of industrial gaskets in America.

In requesting copies of this and succeeding issues of "The Gasket," write the company on your business letterhead, mentioning your position.

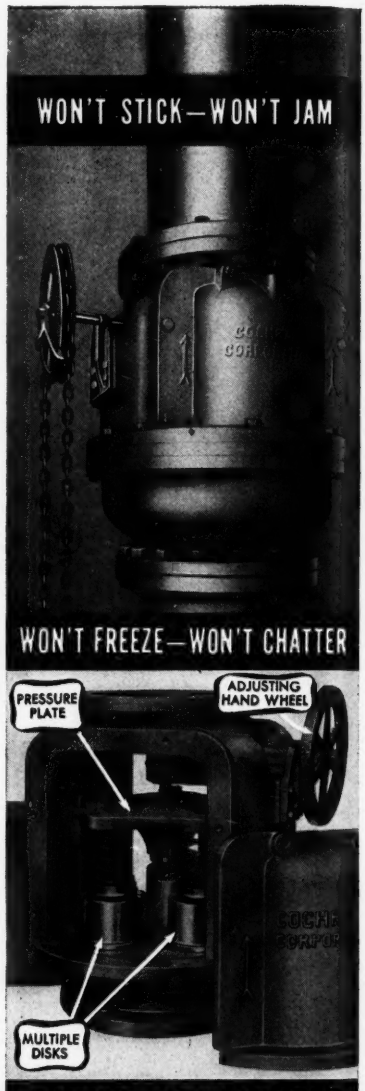
GOETZE GASKET & PACKING CO., Inc.
17 Allen Avenue, New Brunswick, N. J.

Goetze for GASKETS

hontas Fuel Co., 820 Statler Bldg., Boston, Mass.; Granville W. Anderson, Koppers Coal Division, Ford Bldg., Detroit, Mich.; Thomas P. Bateman, Consolidation Coal Co., Buhl Bldg., Detroit, Mich.; Harry N. Holloway, Island Creek Coal Sales Co., 1914 Book Bldg., Detroit, Mich.; Alfred D. Muldoon, Chesapeake & Ohio Ry., 7-120 General Motors Bldg., Detroit, Mich.; Frank O. Runnells, Island Creek Coal Sales Co., 1914 Book Bldg., Detroit, Mich.; Joseph A. Morgan, Pittsburgh Coal Co., First National-Soo Line Bldg., Minneapolis, Minn.; Norman Burnside, D. L. & W. Coal Co., 120 Broadway, New York, N. Y.; Wilbur W. Criswell, Jr., United Eastern Coal Sales Corp., 420 Lexington Ave., New York, N. Y.; Edmund McCarthy, Upper Monongahela Valley Assoc., 122 E. 42nd St., New York, N. Y.; Earl C. Payne, Consolidation Coal Co., 30 Rockefeller Plaza, New York, N. Y.; Julian E. Tobey, Upper Monongahela Valley Assoc., 122 E. 42nd St., New York, N. Y.; Paul B. Barkman, Cleveland Cliffs Iron Co., Union Commerce Bldg., Cleveland, Ohio; Homer M. Faust, New York Coal Co., 150 E. Broad St., Columbus, Ohio; Carroll F. Hardy, Appalachian Coal, Inc., Transportation Bldg., Cincinnati, Ohio; Otto J. Menke, Island Creek Coal Sales Co., Dixie Terminal Bldg., Cincinnati, Ohio; William Mittendorf, Holmes-Darst Coal Co., Transportation Bldg., Cincinnati, Ohio; Frank R Stilwell, Red Jacket Coal Co., 115 E Rich St., Columbus, Ohio; Lester C Bosler, Coleman & Co., 123 S. Broad St., Philadelphia, Pa.; Joseph D. Doherty, Koppers Coal Div., Koppers Bldg., Pittsburgh, Pa.; Ernest E. Finn, Anthracite Industries, Inc., 2204 Walnut, Philadelphia, Pa.; Fred J. Kasner, Koppers Coal Div., Broad St. Station, Philadelphia, Pa.; Joseph H. Kerrick, Philadelphia & Reading Coal & Iron Co., 725 Reading Terminal, Philadelphia, Pa.; Lawrence A. Shipman, Southern Coal & Coke Co., Hamilton Bank Bldg., Knoxville, Tenn.; Roy J. Buchanan, Koppers Coal Div., Citizens Bank Bldg., Norfolk, Va.; Frank L. Donaher, Norfolk & Western Ry., Roanoke, Va.; Thomas H. Duffy, Chesapeake & Ohio Ry., 9th and Main Sts., Richmond, Va.; George O. Ellstrom, Norfolk & Western Ry., Roanoke, Va.; James G. Giltner, Norfolk & Western Ry., Roanoke, Va.; Daniel J. Howe, Norfolk & Western Ry., Norfolk, Va.; George A. Morris, Norfolk & Western Ry., Roanoke, Va.; Fred K. Prosser, Norfolk & Western Ry., Roanoke, Va.; Lyndon J. Whitlock, Jr., Norfolk & Western Ry., Roanoke, Va.; David H. Williams, Norfolk & Western Ry., Roanoke, Va.; Minott Brooke, Chesapeake & Ohio Ry., 9th and Main Sts., Huntington, W. Va.; Eugene J. Kerr, Island Creek Coal Co., Huntington, W. Va.; John Scott, New River Co., Mt. Hope, W. Va.; Karl W. Karlson, Republic Coal & Coke Co., Racine, Wis.

Hotel Gibson Appoints New Chief Engineer

THE APPOINTMENT of Lewis A. Steele as chief engineer of the Hotel Gibson, Cincinnati, was announced last week by Randall Davis, general manager. Steele has been an operating engineer at the hotel since 1934, and succeeds William A. Garrett, who leaves after sixteen years at the Gibson, to become chief engineer at Good Samaritan Hospital in Cincinnati.



SAFETY silence and tightness are the outstanding characteristics of the Cochrane Multiport Relief Valve. A number of small disks, each with an independent holding-down spring, are used in place of a single disk. Thousands are giving satisfaction.

COCHRANE CORPORATION
3123 N. 17th Street, Phila. 32, Pa.

COCHRANE
MULTIPORT
RELIEF VALVE

for THIS battle, G.H.Q. is at YOUR own desk!

★ Here's how you—yes, YOU—can carry out a smashing "pincer movement" against the Axis. Swing in on one flank with increased production of war goods! Drive in on the other with redoubled purchases of War Bonds through your Pay-Roll Savings Plan!

You're an officer in both of these drives. Your personal leadership is equally vital to both. But have you followed the progress of your Pay-Roll Savings Plan as closely as you have your production?

Do you know about the new Treasury Department quotas for the current Pay-Roll Allotment Drive? *Quotas running about 50% above the former figures?* You see, these new quotas are based on the fact that the armed forces need more money than ever to win the war, while the average worker has more money than ever before to spend. Particularly so, on a *family income* basis—since in so many families several members are working, now.

Remember, the bond charts of today are the sales curves of tomorrow! Not only will these War Bonds implement our victory—they'll guard against inflation, and they'll furnish billions of dollars of purchasing power to help American business re-establish itself in the markets of peace.

So get this new family income plan working at once. Your local War Finance Committee will give you all the details of the new plan. Act today!

This advertisement prepared under the auspices of the War Advertising Council and the U. S. Treasury Department.

LET'S KEEP ON Backing the Attack!

This Space is a Contribution to America's All-Out War Effort by

POWER PLANT ENGINEERING

Let us tell you about

ARMOR-CLAD

- **How it protects** against flame, slag, and gas penetration, spalling, and premature furnace breakdown.
- **How its exclusive** step-up principle protects against excessive temperature damage up to 3900 deg. F.
- **How it is adapted** to all types of furnaces, Boiler, Metallurgical, and to all fuels, Coal, Gas, Oil, or any electrically operated units.
- **How it greatly expands** the life of your furnace linings, Baffles and Impingement areas.
- **Why it is in successful use** in so many of the foremost Industrial and Metallurgical Plants, in the Army and Navy and Maritime Commission ships wherever America's Furnaces are on the Firing Line.

Let us send you our booklet and an ARMOR-CLAD Coated Brick for your own test.

Cut out coupon below and send it in today.

ARMOR-CLAD COMPANY
39 HYATT AVE., NEWARK, N. J.

Yes, I would like to receive your booklet on furnace wall coatings and a sample brick which has been coated with Armor-Clad.

Name .....
Company .....
Address .....
City..... State.....

STATEMENT of the ownership management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of POWER PLANT ENGINEERING, published monthly at Chicago, Illinois, for October 1, 1943, State of Illinois, } ss. County of Cook, }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Kingsley L. Rice, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Power Plant Engineering and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wite:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Technical Publishing Company, Chicago, Ill.

Editor, R. E. Turner, Chicago, Ill.

Managing Editor, Andrew W. Kramer, Chicago, Ill.

Business Manager, Kingsley L. Rice, Chicago, Ill.

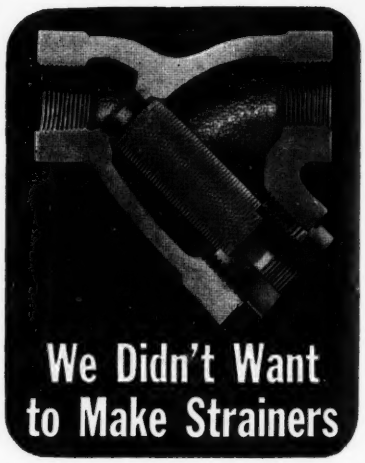
2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Technical Publishing Co., Chicago, Ill.
Arthur L. Rice, Chicago, Ill.
Kingsley L. Rice, Chicago, Ill.
Ralph E. Turner, Chicago, Ill.
C. S. Clarke, Chicago, Ill.
Andrew W. Kramer, Chicago, Ill.
John O. Aarvold, Chicago, Ill.
Otto Kaad, Chicago, Ill.
Walter Painter, Chicago, Ill.
Richard H. Morris, Chicago, Ill.
Edwin C. Prouty, Chicago, Ill.
Madge W. Rice, Wilmette, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant



We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

See its protection against corrosion—*cadmium plating inside and out.*

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removeable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-200.

YARNALL-WARING COMPANY
114 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

HELPFUL BULLETINS

Practical answers to many wartime problems of plant operation and maintenance are found in the engineering bulletins offered by manufacturers. For your convenience we publish the following summary of helpful literature available. To obtain copies of the bulletins and catalogs described, simply indicate the paragraph numbers on coupon on next page, detach and mail.

BOILER PLANT EQUIPMENT

1 Stokers — Bulletin 632 describes the Detroit UniStoker line of single retort, plunger feed, unit type stokers for 125 to 250 hp boilers. Operates successfully on all grades of coking or non-coking coals. Detroit Stoker Co.

2 Coal Handling Systems—New Bulletin No. 125 pictures and describes belt conveyors, crushers for sizing coal and coke, skip hoists, stackers, vibrating screens, car dumpers and other coal handling equipment. Robins Conveyors, Inc.

3 Radiant Heat Boiler—Quick steaming, high ratings, water wall operating economy, moderate height, adaptability to any fuel, are among features of Edge Moor radiant heat boiler described in new Catalog 102. Edge Moor Iron Works, Inc.

4 Coal Pulverizers — Bulletin G-30A describes a line of pulverizers for direct-firing, pulverized-coal systems, available in 15 sizes and in capacities from 3100 lb per hour to 25,400 lb per hour. The Babcock & Wilcox Co.

5 Steam Atomizing Oil Burners—Bulletin No. 21 tells about construction features, capacity and typical applications of National Airoil Type SA oil burners. Photo-diagrams show proper arrangements of burner and furnace with various types of boilers. National Airoil Burner Co.

6 Pulverized Fuel — A bulletin entitled "Utilizing Pulverized Coal in the Metallurgical Industries" describes in detail pulverized coal equipment and includes a number of interesting designs and modern systems utilizing automatic temperature and pressure controls. The equipment described may be quickly installed to replace fuel oil consuming systems, and operating data reveals major economies. The Amsler-Morton Co.

7 Fuel Oil Purifier — Attractively illustrated 8-pg Bulletin 65 shows operating features and typical applications of Honan-Crane fuel oil purifier. Also contains U. S. and metric weights and measures and other useful engineering data. Honan-Crane Corp.

8 Tube Cleaners — Bulletin Y-15, a 4-pg letter-size folder, describes the new Elliott 1300 Series tube cleaner with improved metallurgy, heat-treating and lubrication. The motors have been proportioned so that they can be used to clean both straight and curved tubes, with parts interchangeable with former Lagonda cleaner motors. A page of Elliott tube cleaner recommendations for straight and curved tubes of various sizes is included. The Elliott Co.

ELECTRICAL EQUIPMENT

9 Interchangeable Motors—New 20-pg booklet tells about complete interchangeability, improved insulation, trouble-free bearings and other benefits of R & M uni-shell motors. Only end heads change for polyphase induction, dc and single phase induction types. Robbins & Myers, Inc.

10 Electronic Heaters — Electronic heaters for heating metals are featured in a new, illustrated 8-pg bulletin (GEA-4076) recently issued by the General Electric Co. Publication describes the electronic method of heating metals, emphasizes its simplicity, and gives in detail the specifications of both the 5-kw and the 15-kw, 550-kilocycle, electronic heaters. Also included are illustrations of many important small parts which may be brazed, soldered, or surface hardened by electronic heating.

11 Motors Maintenance—"A Guide to Wartime Care of Electric Motors" is a useful handbook on the maintenance problem of motors under hard service and unfavorable conditions. It is applicable to all types of motors and tells the cause and correction of troubles due to dirt, oil, moisture, vibration, misalinement, wear and overload. A check list of symptoms you can see, hear and feel serves as a diagnosis chart. Allis-Chalmers Mfg. Co.

12 Amplidyne Featured in New Bulletin —The amplidyne, a G-E engineering development which harnesses the usually troublesome short circuit and puts it to work, is the subject of an attractive new 36-pg bulletin (GEA-4053). It describes engineering details and functions of the amplidyne, which in principle is an externally driven direct-current generator which uniquely uses a short circuit and a compensating winding. Also lists several of the amplidyne's typical applications, and in many cases cites figures showing the gain in production levels made through the use of the amplidyne. The final section is devoted to a series of interesting diagrams, with explanatory notes, showing how the amplidyne is employed, in conjunction with other equipment, in various applications. General Electric Co.

13 Lightning Protection—"Lightning" a G-E silent motion picture runs 35 minutes, presents an interesting story on theory and practice of modern lightning protection. Highlights of this film are described in new bulletin (GEA-4056) which should be of special interest to central station engineers and technical schools. General Electric Co.

14 Protected Polyphase Squirrel-cage Motor—Bulletin 1160 tells about the new Fairbanks-Morse all-purpose polyphase squirrel-cage induction motor. Constructed with the centrifugally-cast F-M Copperspun Rotor, this new motor is fully protected against flying chips, falling particles, dripping liquids, and other industrial motor hazards. The ball bearings sealed in cartridge-type housings minimize expensive shutdowns due to bearing failures. Has cross-flow ventilation; is rated 40°C and designed to carry 115 per cent load continuously without injurious heating. Fairbanks, Morse & Co.

FANS, PUMPS AND COMPRESSORS

15 Pumping Hand Book—New Westco Industrial Pumps Catalog No. 43 gives specifications and performance data on pumps for boiler feed, brine circulation, condensate and many other jobs. Contains units of measurement, heads and pressure equivalents and other handbook information. Joshua Hendy Iron Works, Pomona Pump Div.

16 Deep Well Pumps—Improved methods of pumping water from deep wells are described in new pump Bulletin 141A. Cross-sectional views of deep well pumps, revealing the shafting and submerged pump elements demonstrate the operation of lifting water from any depth. Various types of pump heads are included, to illustrate application of power, for direct motor connection, belted drives, geared power and combinations of these. Peerless Pump Co.

17 Time-Saving Compressor Calculator —An ingenious compressor calculator, designed to save time in computing compressor requirements or in estimating the performance of present compressor units, has been prepared by The Cooper-Bessemer Corp. The calculator is pocket size, of slide rule design; can be used for quickly estimating the volumetric efficiency, brake horsepower and total piston displacement of any make of compressor.

18 Controllable Capacity Pumps—Bulletin 65 gives full details, sizes and ratings of Aldrich-Groff pumps which provide for automatic or remote manual control of delivery, from zero to capacity, at constant pump speed. The Aldrich Pump Co.

INSTRUMENTS AND CONTROLS

19 Frequency Meters—New 8-pg bulletin describes the JBT vibrating-reed frequency meter, its advantages and extensive application on engine-generator sets, in laboratories, central stations, and industrial plants. Lists data on various models with illustrations. JBT Instruments, Inc.

20 Combustion Control Systems—How to cut attendants time and produce more heat with less fuel is explained in Bulletin No. 300 on Cash standard automatic combustion control systems. Units for control of air flow, fuel feed, draft, may be combined to fit every boiler need. A. W. Cash Co.

21 Pneumatic Control—Catalog N-OOB, 16-pg, stresses use of Micromax pneumatic control for regulation of pH, conductivity and other conditions, as well as temperature. Controller is described as completely factory-assembled, ready to be connected to valve, thermocouple or other primary element, and to electric power. Also gives standard ranges, dimensions, shipping weight, etc. Leeds & Northrup Co.

22 Stroboscopic Tachometer—Descriptive folder tells about the Strobomeca, a simple instrument little larger than a baseball, that measures rotational and vibratory speeds. Can be used to indicate speeds of inaccessible moving parts. Boulin Instrument Co.

23 Water Level Indicator—New bulletin deals with application and operating advantages of Yarway Remote Water Level Indicator. This device brings boiler water levels down to eye level reading on a brilliantly illuminated, two-color scale mounted on the plant's instrument panel or other convenient location. Bulletin describes the unique mechanism and methods of installation; also shows the instrument in use in the boiler rooms of leading utilities, industrial plants and institutions. Yarnall-Waring Co.

24 Control for Industrial Processes—The G-E Cabinetrol, a new, simplified system for providing motor control for complex industrial processes, is the subject of a 24-pg illustrated bulletin (GEA 3856). It describes how most control systems can be built up by combining standard control units and accessories into the required number of Cabinetrol sections. A section of the bulletin is devoted to a set of layout tables which show how simply most installations can be made, while another section lists the compartment sizes of the standard Cabinetrol units. General Electric Co.

25 Hydraulic Control—Bulletin 78-D tells about the Sperry Extractor hydraulic control for operation of industrial, marine and aircraft equipment. This single tube remote control system, capacity up to 400 in. lb, is said to give motion through 55 deg without time lag or backlash. Sperry Products, Inc.

26 Draft Control Data—Timely 16-pg bulletin tells about a simplified, automatic draft control device, the Draft-A-Justor. It operates by barometric pressure, automatically compensates for variations in outside temperature, pressures, wind velocity and direction. Bulletin has data on the effects of this sensitive control of draft on—boiler efficiency, boiler maintenance, automatic firing control, control of fly ash and cinder nuisance. Preferred Utilities Co., Inc.

27 Pressure Controls—A new bulletin titled, "Askania Pressure Control," describes the application of Askania regulator equipment to pressure and flow control problems. Installation photos and diagrams show how the equipment is used. Unique valve sizing chart, published for the first time, shows how butterfly valve sizes may be determined in a quick and easy manner. Askania Regulator Co.

PIPING VALVES AND FITTINGS

28 Steam Trap Handbook—Typical installations of Yarway impulse steam traps and strainers in many different industries are shown in new Bulletin T-1738. Contains trap operating suggestions, pipe dimension table, thermodynamic properties of saturated steam and other helpful engineering data. Yarnall-Waring Co.

29 Seamless Flexible Metal Hose—Bulletin H 201-935 furnishes engineers complete data covering the physical properties and other pertinent information. Generously supplied with illustrations and diagrams, it is invaluable to engineer, designer, and specification man. Eclipse Aviation Seamless Flexible Metal Hose, Philadelphia Div. of Bendix Aviation Corp.

30 Welding Fittings and Flanges—For stronger, lighter, permanently leakproof piping systems, many plants use Tube-Turn fittings. No torch cutting or fitting fabrication needed. Helpful catalog and data book No. 111 contains 232 pg of technical studies and engineering data. Tube Turns, Inc.

31 Bucket Steam Trap—Described in Catalog No. 350 are the big capacity and other advantages of the Sarco bucket steam trap for steam mains, process steam lines, tanks, dryers, presses, etc. Made in standard ranges up to 250 lb. Sarco Co., Inc.

32 Insulation Liner for Pipes—Insidline, an insulation liner for pipes under pressure at temperatures above 1000 deg F, is fully described in new booklet. This liner makes it possible to design pipe systems with less elaborate, less expensive allowances for expansion. Baldwin-Hill Co.

33 Power Vise Stand—New manual covers operating and maintenance suggestions on the Oster No. 422 Power Vise Stand which eliminates threading pipe by hand. Helpful pictures and text show how to connect motor, thread and ream pipe, thread small bolts, etc. The Oster Manufacturing Co.

34 Quick-Closing Gage Valves—Bulletin 418 explains construction features of Reliance gage valves which make for steam-proof and leak-tight service. Pressures up to 450 lb. Reliance Gauge Column Co.

35 All-Purpose Traps—Bulletin 242 describes the Nicholson line of thermostatic industrial traps, available in five sizes, ¼ in. to 2 in., pressures up to 300 lbs. Catalog 941 gives complete data on high pressure traps—weight operated for pressures to 1500 lbs—piston operated for pressures to 650 lbs. W. H. Nicholson & Co.

36 Flexible Coupling Handbook—An unusual combination of catalog and engineering manual has been prepared by the Victaulic Company of America. The new Victaulic handbook is a comprehensive listing of flexible couplings and fittings for use with grooved pipe, as well as a guide to their use in industrial, mining, petroleum, shipbuilding, and water works and sewerage fields. The engineering and catalog material have been tabulated by industries to facilitate its quick and easy use.

37 Steel Valves—New folder highlights construction and operating features of Edwards cast and forged steel valves for stop, check, non-return and blow-off service. The Edward Valve & Mfg. Co.

38 New Condenser Tube Manual—New 112-pg Condenser Tube Manual fulfills the need for a compact ready-reference on tubes used in condensers, heat exchangers and evaporators found in power plants, ships, oil refineries and process industries. It deals with comparatively new and more corrosion-resisting alloys, such as Duronze IV, Cupro Nickel, Cuzinal, as well as improved Admiralty, Muntz and copper; discusses effects of electro-chemical theory of corrosion, types of protective films, oxygen and debris, impingement corrosion, operating conditions, etc. Gives latest A.S.T.M. and Federal Specifications on standard alloys, comprehensive weight tables, steam notes, methods of installing and packing, cutting and removing condenser tubes. It also contains weight tables and data on brass and copper pipe, copper water tubing and navy type copper tubing. Bridgeport Brass Co.

39 Figuring Pipe Thickness—New Bulletin 43-A will enable you to determine easily the required pipe wall thicknesses for commercial pressure and temperature conditions. All you do is select a factor from a table, divide it into the working pressure, refer quotient to a chart. Midwest Piping & Supply Co.

PRIME MOVERS

40 Turbines—20-pg catalog, No. GEA-1145D, covers Type D mechanical-drive turbines with photographs and diagrams illustrating construction features and general specifications. Also furnishes dimensions and typical installation photographs. General Electric Co.

41 Diesel Engine Testing—"Maintaining Diesel Engine Dependability" is the title of new 20-pg bulletin explaining how compression and firing pressures of any Diesel can be determined quickly and accurately with Premax Pressure Indicator. Bulletin contains comparative operating data on Diesel performance before and after using Premax. Bacharach Industrial Instrument Co.

42 Mechanical Drive Turbines—A series of bulletins describe the complete Terry line of mechanical drive turbines. Bulletin SR-114 covers the Multi-stage turbine; Bulletin S-107 describes the Axial Flow Impulse turbine; Bulletins S-116 and S-99 describe the Solid Wheel turbine. The Terry Steam Turbine Co.

43 Gas Engines—Bulletin No. S-550-B21 covers CCG gas engines, vertical, 4-cycle, totally enclosed, adaptable to generator, pump, compressor and other power drives. Also includes typical installation photographs. Worthington Pump and Machinery Corp.

WATER TREATMENT

44 Water Clarification—Bulletin 29 furnishes data on the use of Nalco No. 41 in the clarification of water, through pressure filters, for beverages, cooking or process work, swimming pools, ice plants, etc.; also in oil removal filters. National Aluminate Corp.

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45 Chemical Supply Agitating System —Bulletin W-212-B2 on the Worthington water softener explains how circulation of liquid chemical supply through stationary diffuser maintains uniform chemical strength without use of moving parts. Also describes other Worthington features. Worthington Pump & Mach. Corp.

46 Water Treatment Data Book—Completely revised data book on water treatment contains 78 sections of data in addition to 36 tables and 10 graphs. It has hundreds of chemical conversions and equations. Gives methods of calculation of water conditioning problems and should be in the library of every engineer or chemist who comes in contact with water treatment. Permutit Co.

47 Chemical Feeders — Bulletin describes Manzel chemical feeders for automatic boiler feed water treatment. Installed on boiler pumps, they automatically feed a small amount of chemical into the line with each pump stroke. Easily adjustable to fit your exact requirements. Manzel Brothers Co.

48 Proportioning Equipment for Corrosive Fluids — Cochrane Publication 2985-A describes an ingenious and simple method of proportioning sulphuric acid to water supplies. Accuracy is obtained without the use of any moving parts in contact with the corrosive liquid—giving long life and insuring low maintenance charges. The principle of operation is described fully, with its many advantages and applications. Cochrane Corp.

MISCELLANEOUS

49 Water Heaters — ADSCO Bulletin No. 35-75C illustrates and describes horizontal and vertical storage water heaters with U-tube heating elements, including details of construction, sizes, capacities and dimensions, etc. American District Steam Co.

50 Controlled Materials Plan — New 16-pg booklet entitled, "The Controlled Materials Plan—A Simplified Explanation of Purposes, Principles and Procedures," has been prepared to assist key individuals in war industries gain a sound working knowledge of CMP. Booklet covers such topics as "What Materials Are Controlled?"; "Are Your Products A or B?"; "How Are Controlled Materials Distributed to Producers?"; "Buying Maintenance, Repair and Operating Supplies." Manning, Maxwell & Moore.

51 Packing Guide—Catalog 40 is a valuable guide on packings for all services. Clearly illustrates and describes various packings of this company; suggests varied packing styles from which to choose a substitute packing. Also presents engineering data and other informative charts. The Belmont Packing & Rubber Co.

52 Helpful Gasket Chart Available—An up-to-the-minute Gasket Chart showing the cross-sections of 36 most popular gasket types, their purposes and the characteristics which fit them for the specific services intended, is now available to interested engineers. This chart is featured in the second issue of "The Gasket"—a series of technical papers on Gaskets compiled by the Research Laboratory of the Goetze Gasket and Packing Co.

53 Heat and Power Conservation Manual — Industrial Heat and Power Conservation Manual provides understandable, down-to-earth information on these questions: How do I find heat and fuel losses?—How do I figure how much can be saved?—How long will it take to cover the cost of insulating in fuel savings?

Time saving graphs, tables, formulae and examples on the back of the heat loss sheet make it possible for even the layman to work through a heat loss survey. Industrial Mineral Wool Institute.

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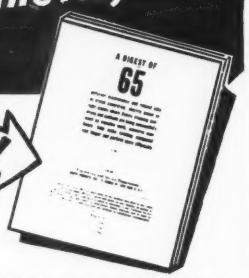

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NEW ENGINEERING BOOKS

Magnetic Circuits and Transformers. By The Electrical Engineering Staff at The Massachusetts Institute of Technology. First edition, 718 pp, 378 illustrations, 6 by 9 in. cloth. John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1943. Price $6.50.

This comprehensive book is the second volume in the Principles of Electrical Engineering series prepared by members of the staff of the Department of Electrical Engineering at M. I. T. A review of the first volume dealing with Electric Circuits was presented in these pages in the October 1941 issue.

The staff at M. I. T. has for some years been engaged in an extensive program of revising substantially its entire presentation of the basic technological principles of electrical engineering and these volumes are the result of this work. A third volume dealing with the subject of applied electronics is announced as this review is being written.

This volume is intended as a first course for power and communication engineers. This is somewhat unique. Usually texts on power and communication are quite different, even in their treatment of basic material and, so, the fact that in this book practical applications are made to both heavy-current and light-current control, measurement and communications problems is of particular interest.

The first part of the book deals with magnetic circuits. It includes an extremely interesting chapter discussing the current theory of ferromagnetism, the derivation of the magnetic circuit concept, and the development of the fundamental principles for computation of the behavior of magnetic circuits. Also included are a treatment of iron-core reactors by means of the model theory and a concise summary of thermal circuit problems. Part II, on transformers, surveys first some general principles involved in the design and manufacture of all electric apparatus and then applies the general principles to transformers and continues with analysis of their electrical characteristics. Two methods of analysis are given, and their interrelations stressed: the reso-

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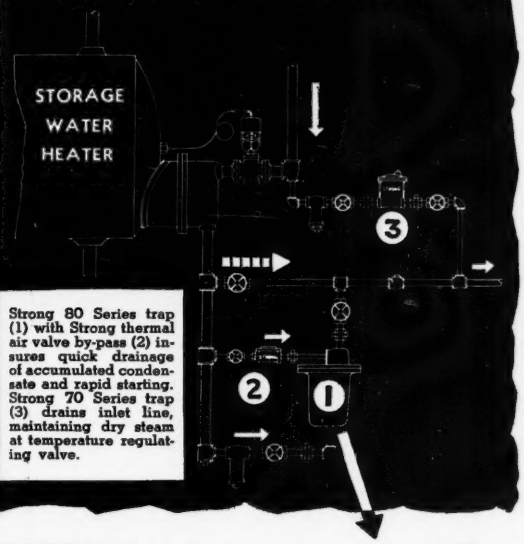

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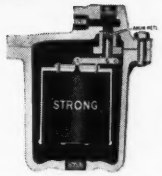

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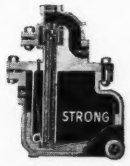

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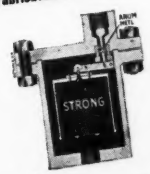

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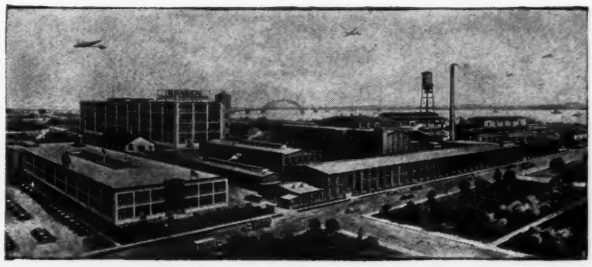

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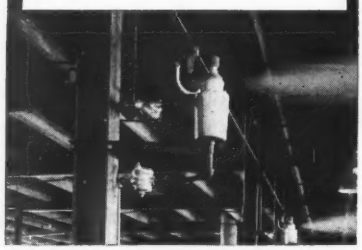

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lutions of the magnetic fields of transformers into leakage and resultant mutual components, and the classical theory of coupled circuits.

The treatment given assumes that the reader has knowledge of electric circuit theory as given in the first volume of the series or in other textbooks on a similar level. Mathematics through differential equations is freely used; not, however, as a substitute for the explanation of physical phenomena but rather as a means of describing quantitatively their consequences. In all instances emphasis is placed on fundamental principles important to students of electrical engineering regardless of what their fields ultimately may be.

Basic Electricity For Communications. By W. H. Timbie. First edition, 603 pp, 5½ by 8½ in. cloth. John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1943. Price $3.50.

Those who have been familiar with Professor Timbie's many useful books on various branches of electrical engineering need hardly be told that this is an excellent book for those who need a practical book. All of Professor Timbie's books are practical, and this is no exception. It is designed for the practical man who wants help in dealing with the many new problems that arise in connection with modern industrial electronic developments and in communication work. This book presents those basic electrical principles with which the worker in these fields must be thoroughly familiar.

As the author points out in the preface, the plan followed is that which had proved so successful in his "Elements of Electricity" used for many years in practical courses in electricity. Facts and theories are presented by simple, direct statements. New theories are approached through familiar illustrations and applied to the common practical problems of modern practice in communications and industrial electronics.

Specifically it contains, 1. An adequate amount of information concerning electrical laws and communication practice in an immediately usable form. 2. It applies the information contained in real situations and modern equipment and not to abstract theory and the juggling of mathematical formulas. 3. It provides sufficient drill in concrete practical problems, which not only afford in themselves an additional amount of information, but also develop in the student a capacity for applying what he has learned. 4. It presents, out of the great mass of electrical phenomena only those facts and principles which the student in electronics or communications needs to know and to know well. History and general theory, interesting as they are, have been omitted.

Numerous photographs and diagrams illustrate and analyze the tools of production. Actual job problems are used throughout to demonstrate step-by-step how to solve electrical and communication problems that arise in practice.

The author is professor of electrical engineering and industrial practice at Massachusetts Institute of Technology.

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Write for Bulletin PP-14

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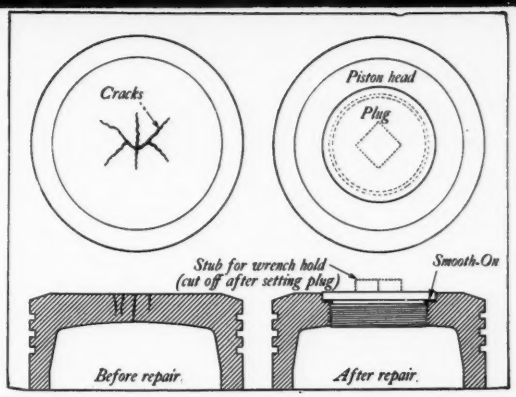
A low-cost repair that saves Diesel Engine piston replacements



WHEN the piston head of a Diesel or other internal combustion engine has been burnt or cracked from the extreme temperatures, the Smooth-On repair shown above will restore the initial strength of the piston and effect a large saving over the cost of a new piston.

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Do it with **SMOOTH-ON**

edition, 335 pp, 6 by 9 in. cloth. Chemical Publishing Co., Inc., 234 King Street, Brooklyn, N. Y., 1941. Price $5.00.

All engineers interested in the future of their profession should be interested in this book because if some of the implications of its subject matter should happen to come true, the lot of the "power" engineer, at least, will be very different from what it is today. If, for example, we learn how to produce a certain type of uranium—uranium 235—in considerable quantities, the chances are that this element would supplant all present fuels and we would derive all the energy needed in the world from its disruption. One can readily appreciate this when it is known that the energies released in the fission of uranium 235 are fully 40,000,000 times greater than those released by one molecule of T. N. T. in exploding.

Ever since its discovery uranium has been associated with the great events in science. It has been the "water boy" for spectacular plays in chemistry and physics. For some years the element was forced into comparative obscurity by the acclaim for radium and X-rays. But more recently, uranium has come into its own for, with the recent developments in nuclear fission, the future of uranium has been accorded an extremely bright outlook. At the present time uranium 235 holds the greatest possibilities as a future source of atomic power. The separation of U235 from other uranium isotopes is already a laboratory fact but, of course, much remains to be done to develop this fact into commercial realization. Many physicists believe that atomic power may be obtained from uranium in the near future. Others hold to the premise that such an accomplishment is still in the distant future or may never come to pass. It is the opinion of the authors of this very interesting book that the gravity of evidence now at hand should favor an optimistic outlook.

Jack DeMent is research chemist at the Mineralogist Laboratories while H. C. Dake is the editor of the Mineralogist Magazine. They discuss the subject of uranium from the chemical viewpoint but on the whole the book is of interest to the general reader even though only casually interested in the subject. They present a very complete account of the history of uranium and of the work that has been done in the field of uranium investigation.

While uranium research is far removed from the activities of most power engineers, this book nevertheless should be of interest to those engineers who have imagination and who are interested in the broader aspects of their profession.

Electricity. By Charles A. Rinde. First edition. 466 pp, 7 by 9½ in., cloth. Harcourt, Brace and Company, 383 Madison Avenue, New York, N. Y., 1943. Price $1.96.

This is a book on the fundamentals of electricity for those new workers in industry and for the men and women in the armed services who require such knowledge as a basis for various kinds of specialization. While not a popularization, it nevertheless is a book that the intelligent layman should be able to understand.

The book is organized around the War Department's outline, "Fundamentals of Electricity" (PIT-101), but the outline, according to the author, has not been followed slavishly. A central theme unifies the book: the control of electrons. Magnetism and electricity, separately introduced, are brought into close relationship in certain divisions. The control of electrons appears very early in the book and grows in variety and importance until the last chapter.

The principles developed in the early sections of the book are applied again and again in later sections. This recurrence should make acquaintance with them easy and much like that of experience, and should lead readily to the generalizations and understandings that add most to one's permanent knowledge.

A large part of each chapter is devoted to detailed explanations of electrical devices. Readers, no doubt, will find the majority of these explanations interesting in themselves but their chief purpose is not to present the device as such, but merely as an example of electricity being used or controlled in a certain way. The significance of an electric bell, for example, is that an electromagnet acts on a piece of iron carrying contacts that break the electromagnet's own circuit.

As the author points out in the preface, it is inherent in the nature of alternating currents that their behavior in electric circuits is more complex than that of direct currents. Therefore, a large proportion of the detailed cal-

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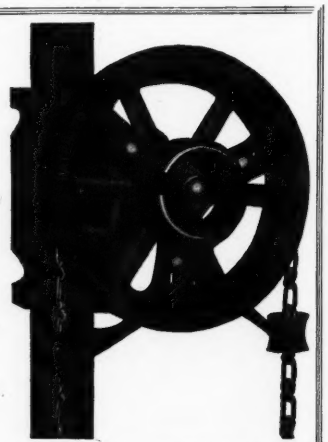

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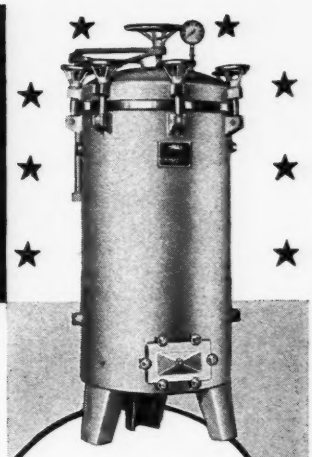

Telephone and telegraph . . . radio and radar . . . ignition and firing coils . . . communications between war plants . . . commanders and fighters . . . planes to gun batteries . . . ships to shore . . . effective operations of trucks, jeeps, planes, boats would not be possible without tiny, thin copper wires. But its production can be a problem as this true example shows. A manufacturer of enameled wire was troubled with wire dust building up in the enamel bath . . . breaks per hundred feet were high . . . four enamel coats were necessary. By installing a Bowser Filtration system, breaks are only ⅛ to 1/10 as many . . . and the job is done with one less coat of enamel. Bowser systems are used for many liquids including cutting, grinding, honing and other oils. If you have a filtration problem . . . call on Bowser for its solution.

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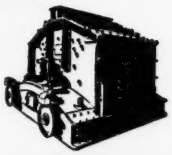
Reduce R.O.M. for Stoker or Pulverizer feed with absolutely no oversize and low "over-grinding." Crush by *gravity-impact*. Automatically eject, without damage, tramp iron, mine debris and hard rock. Low H. P. . . . slow speed . . . long life. Low upkeep . . . rugged . . . thoroughly dependable. 25 to 500 T.P.H. Steelbuilt. Patented.



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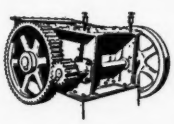

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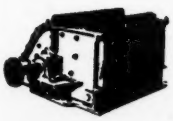

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culations can be made only with the aid of advanced mathematics. But the basic principles of alternating current do have to be understood so every effort is made to present these principles and their applications simply, yet fully enough to permit more than superficial, hence worthless, understanding.

The volume is very well illustrated both with diagrams and photographs. The latter are extremely interesting in that they show the most modern types of equipment; for example, views of the degausing equipment used on ships to protect against magnetic mines.

Summing up, this is one of the very best elementary books on electricity that has been published in recent years. It should be valuable to all those desiring a working knowledge of electricity. Practical men, not having had the advantage of formal training in electricity, will find it instructive and valuable. Note the price; it gives a lot for little money.

Fundamentals of Radio. By L. O. Gorder, Kenneth A. Hathaway and Carl H. Dunlap. First edition. 373 pp, 5½ by 8¼ in. cloth. American Technical Society, 850 East 58th Street, Chicago, Illinois, 1943. Price $2.00.

Believing that a working knowledge of, at least, the simple fundamentals of radio will aid the power engineer and the plant electrician in understanding the electronic devices that are coming into use in industry, we feel that this book on "radio" should be of interest in these pages.

It is one of the simplest books on the general subject of radio that has come to our attention. It is intended as a first level course and like a number of other books published recently by the American Technical Society, is aimed at the men in the armed services requiring various operational skills. The text is devoted to the fundamental principles of radio and the way these principles are applied to radio transmitting and receiving sets. Mathematics has been kept to the substitution of numerical values in the formulas, which are worked by simple arithmetic.

Slide Rule Simplified. By Charles O. Harris. Size 5½ by 8½ in.; 250 pp; cloth bound. Published by The American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. 1943. Book accompanied by Dietzgen 10-in. wooden practice slide rule. Price $2.50 for both book and rule.

One of the principal aims of this book is to show how easy it is to learn to operate a slide rule by explaining clearly and simply, with many good illustrations, exactly what the slide rule is, what it is used for, its advantages, its construction and operation, and then in detail the various operations that can be performed on it. The book is written in the most non-technical manner that can be adopted for the subject, but at the same time care is taken to use the common technical terminology and to explain exactly what this terminology means.

Although the practice rule included with the book is a wooden rule and intended only for use in practicing the operations described in the book, still it is standard in every other respect and should serve the learner well until he can justify the purchase of a standard rule. It is a 10-in. Mannheim slide rule with CI and K scales.

The book opens with complete instructions on how to read the different scales of the rule accurately and precisely. This is followed by details of each type of calculation; that is, multiplication, division, combinations of the two, the square and square root, and the cube and cube root. These are discussed in such a way that they can be mastered by the reader who studies alone as well as those who study in classrooms and it can be followed by anyone who has studied arithmetic and can multiply and divide. On the other hand, the material in the final chapters deals with sines and cosines, the tangent of an angle and the log and anti-log. These are somewhat more difficult for the beginner, but still not beyond his reach.

Instructions are given on locating the decimal point, handling negative numbers, there is a chapter on how to check a slide rule and the answers to all numerical problems are given at the end.

The book does not make it perfectly clear that the slide rule cannot be an accurate calculating machine, that it is of greatest value only for numbers of three significant figures and even then gives only a close approximation, that one of its principal advantages is in checking long-hand computations. However, these cautions would only scare the beginner and the object is to get him to use the rule as quickly and frequently as possible. Except for that minor criticism, this writer feels the author has done a very good job.

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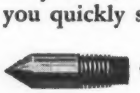 cone valve disc *or* seat.

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Power Plant Construction News

Ark., Jonesboro—Water and Light Department has preliminary plans under way for expansion in municipal steam-electric generating station, as a postwar project, including installation of a new generating unit and auxiliary equipment, estimated to cost close to $300,000. Also proposes extensions and improvements in municipal electrical distribution system.

Colo., Empire—Molybdenum Corp. of America, Inc., 500 Fifth Ave., New York, N. Y., plans installation of electric power equipment in new mill at Urad mine, Empire, to have a rated capacity for handling about 200 tons of ore per day. Cost reported over $400,000, with machinery. Work is scheduled to proceed at once.

Conn., Stratford—United Aircraft Corp., Vought-Sikorsky Division, 550 Main St., plans installation of electric power equipment in new one-story addition, about 250 x 500 ft, for expansion in parts and assembling departments. Cost reported in excess of $1,000,000, with machinery. Erection will begin at early date. Albert Kahn Associated Architects & Engineers, Inc., New Center Bldg., Detroit, Mich., is architect and engineer.

Ind., Fort Wayne—Farnsworth Television & Radio Corp., 3702 East Pontiac St., manufacturer of radio apparatus, plans installation of power equipment in new one-story addition, reported to cost about $250,000, with machinery. Output will be used by Government which will provide financing in amount noted through Defense Plant Corp., Washington, D. C., Federal agency. Work will begin at early date.

Iowa, Bloomfield—Southern Iowa Electric Cooperative, Inc., Bloomfield, will make extensions in distribution lines in Davis County, with service connections and other facilities. Fund of $25,000 has been secured through Federal aid and work will be carried out soon.

Mass., Chicopee Falls—United States Rubber Co., Fisk Tire Division, plans installation of electric power equipment in new four-story and basement addition to mill, about 125 x 350 ft, reported to cost in excess of $550,000, with machinery. Work will be placed under way soon. Lockwood, Greene Engineers, Inc., 10 Rockefeller Plaza, New York, N. Y., is architect and engineer.

Mich., Dearborn—Ford Motor Co., has contracted with Government for expansion in certain plants in Michigan, exact works not specified, including new buildings and facilities for considerable increased capacity. Electric power equipment will be installed. Projects are estimated to cost about $1,800,000 and $1,330,000, respectively, with financing in both cases provided by Defense Plant Corp., Washington, D. C., Federal agency, which will retain title to property.

Minn., Pelican Rapids—Lake Region Cooperative Electric Association, Pelican Rapids, plans extensions in distribution lines in Otter Tail County, including service connections and other facilities. Cost estimated close to $100,000, with financing secured through Federal aid. Proposed to begin work soon.

Mont., Circle—McCone County Electric Cooperative, Inc., Circle, plans installation of transmission and distributing lines in parts of McCone County, totaling over 350 miles, with service connections and other facilities. Proposed to secure power supply from Montana-Dakota Utilities Co., making connection with high-tension system at Wolf Point, where power substation will be located. Entire project will cost close to $325,000. Proposed to arrange financing through Federal aid and secure a priority rating.

Mont., Livingston—Northern Pacific Railroad Co., Fifth and Jackson Sts., St. Paul, Minn., has approved plans for large expansion in railway repair shops at Livingston, comprising group of new one-story buildings for machine shop and other mechanical service. Electric power equipment will be installed. Company will remodel acetylene generator plant at yard, with installation of additional equipment for increased capacity. Entire project is estimated to cost about $1,400,000. Work will be carried out soon.

N. J., Hoboken—White Metal Mfg. Co., 1012 Grand St., manufacturer of

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for trouble-free valve jobs

In renewing the disc, note how easily and quickly the Vulcodisc Jiffy Disc Holder slips off the stem head. Only the disc lock nut to remove and the old disc is off and replaced in a jiffy.

Dense without being brittle—tough, yet resilient, Vulcodisc will not swell, warp or soften—in fact its absorption is less than 1 per cent. . . That is why an old Vulcodisc comes out of the disc holder as easily as a new one goes in. No need for hammer and chisel to cut the disc out in pieces—distorting and disfiguring the holder.

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Squires Reducing Valve

Will maintain the constant pressure desired regardless of initial pressure. It is a dead end valve.

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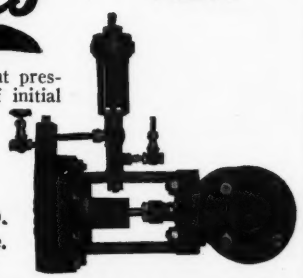

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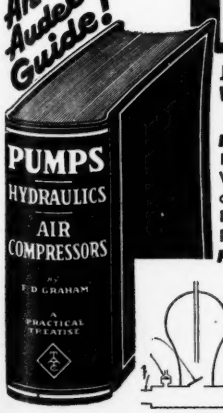

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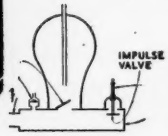

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collapsible metal tubing, plans installation of electric power equipment in new one-story addition, about 60 x 135 ft, reported to cost close to $60,000, with machinery. Work is scheduled to begin at once.

N. J., Princeton—Heyden Chemical Corp., 50 Union Sq., New York, N. Y., manufacturer of drugs, pharmaceuticals, etc., plans installation of electric power equipment, refrigerating machinery, temperature control apparatus, etc., in new one and multi-story plant on 50-acre tract of land near Princeton, for production of "Penicillin," new bacteria-killing drug. A boiler house is planned for central-heating service. Entire project will cost about $1,000,000, with financing provided by Defense Plant Corp., Washington, D. C., Federal agency. Work will begin at once.

N. Y., Brooklyn—Charles Pfizer & Co., Inc., 11 Bartlett St., manufacturer of drugs and pharmaceutical products, plans installation of electric power equipment, refrigerating machinery, temperature control apparatus and other equipment in new local plant at 400-12 Marcy Ave., where a former factory has been acquired, and will be remodeled for production of "Penicillin," new bacteria-killing drug. Equipment will be provided for large output. Cost estimated over $700,000. Work will proceed at once.

N. Y., Pearl River—Lederle Laboratories, Inc., manufacturer of pharmaceutical products, will carry out expansion in local plant for manufacture of "Penicillin," new bacteria-killing drug, for Government, including additional building with machinery for large output. Electric power equipment will be installed. Entire project will cost about $470,000, with financing provided by Defense Plant Corp., Washington, D. C., Federal agency. Work is being placed under way. Company is a subsidiary of American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y.

Ohio, Cleveland—Victoreen Instrument Co., 5806 Hough Ave., manufacturer of precision instruments and parts, plans installation of electric power equipment in new plant on Perkin Ave., near East 36th St. Cost estimated about $90,000. W. S. Ferguson Co., 2362 Euclid Ave., is consulting engineer.

Ohio, Mansfield—Mansfield Tire & Rubber Co., 515 Newman St., plans installation of electric power equipment in new five-story and basement mill addition, reported to cost in excess of $200,000, with machinery. Bids are scheduled to be asked soon on general erection contract. Charles W. Conklin, Mansfield, is architect.

Ohio, Toledo—Fiske Brothers Refining Co., 1500 Oakdale Ave., manufacturer of lubricating oils, greases, etc., plans installation of electric power equipment in connection with proposed rebuilding of portion of plant, recently destroyed by fire, with loss reported over $200,000. Main offices are at 129 Lockwood St., Newark, N. J.

Okla., Tulsa—Public Service Co. of Oklahoma, Public Service Bldg., has completed plans for new control and switching station for service in city area. It will be constructed in three sections, with gross rating of 375,000-kw. Cost estimated close to $100,000. A building permit has been issued and work will proceed at once.

Pa., Pittsburgh—United States Coal & Coke Co., Frick Bldg., Pittsburgh, is reported planning installation of new coal-cleaning and preparation plant at one of coal mining properties, exact location not announced, comprising several buildings with machinery for large tonnage. Electric power equipment will be installed. Cost reported over $2,000,000.

Texas, Waco—General Tire & Rubber Co., 1708 East Market St., Akron, Ohio, plans new branch mill at or near Waco, exact location soon to be determined, comprising several large one and multi-story buildings, to be equipped for initial capacity of about 3000 tires per day. Electric power equipment will be installed. Proposed to build a power house for mill service. Entire development is reported to cost about $3,500,000.

Vt., Montpelier—State Department of Buildings, State House, plans boiler plant for central-heating service in proposed new state office building, now being arranged as a postwar project. It is estimated to cost over $500,000. Freeman, French & Freeman, 138 Church St., Burlington, Vt., are architects; Jaros, Baum & Bolles, 415 Lexington Ave., New York, N. Y., are consulting engineers.

Wash., Seattle—Puget Sound Power & Light Co., Electric Bldg., has approved plans for extensions in power substation on West 45th St, comprising a new building for auxiliary power control service, synchronizing condenser yard and other facilities. Work will be carried out at once. No estimate of cost announced.

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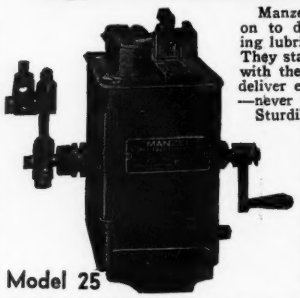

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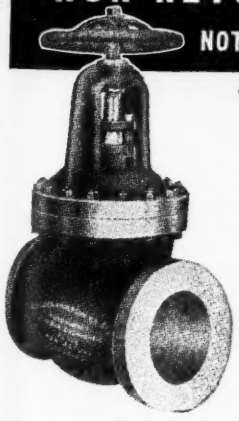

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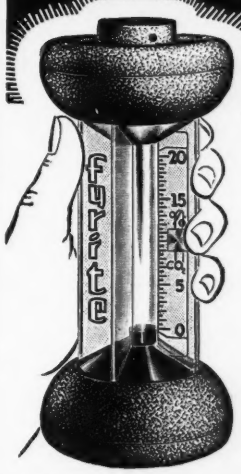

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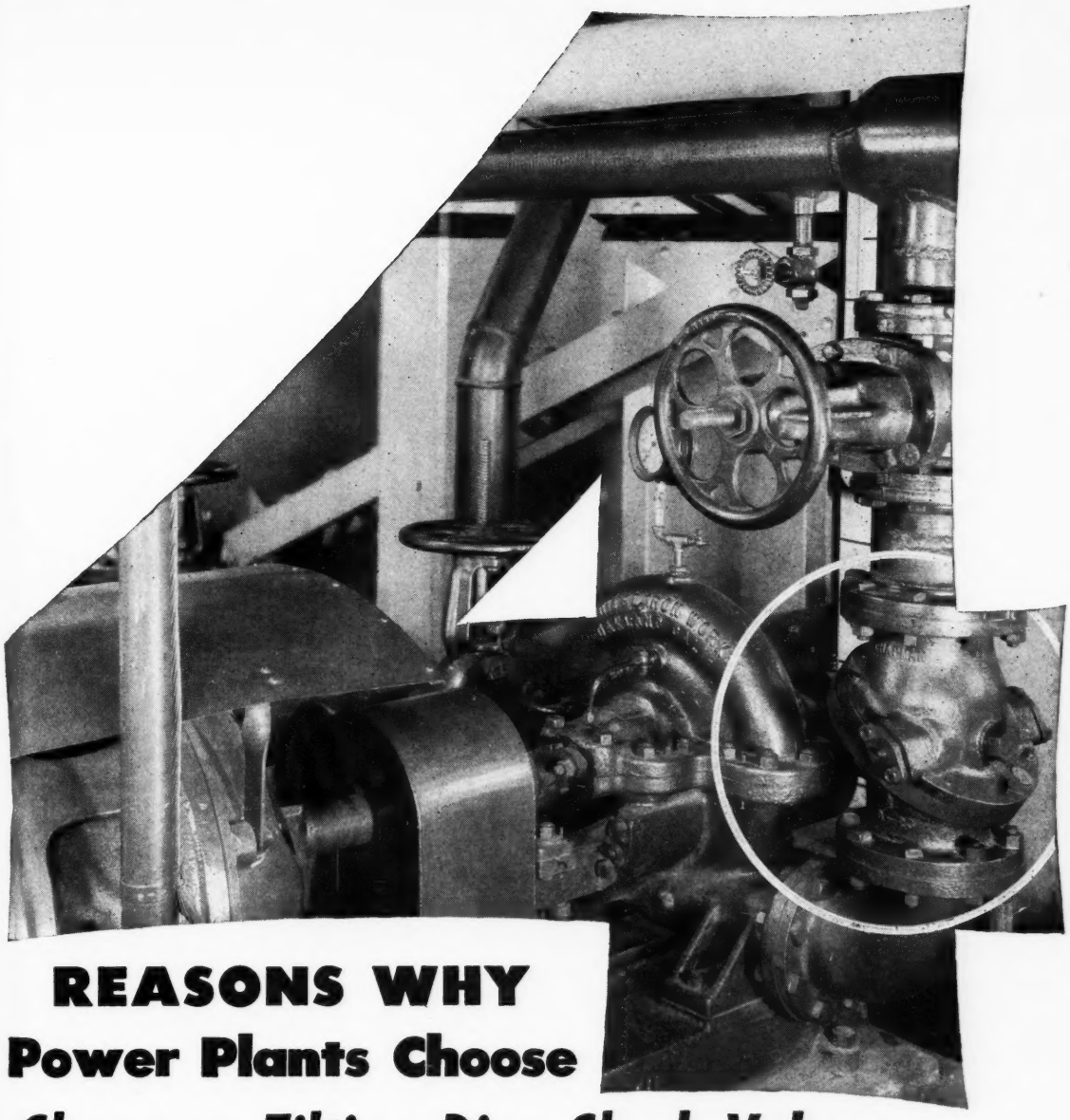

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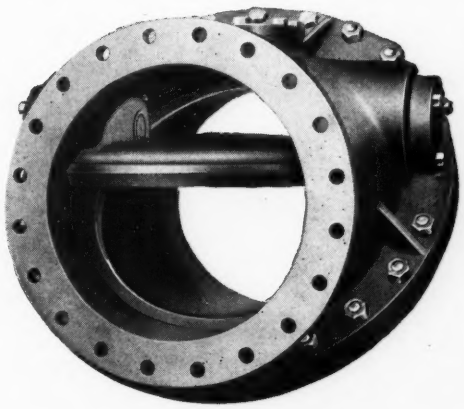

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